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EDITORIAL NOTES.

Gravity for Gas Supply of the Coal Freight Question.

A LETTER written to Lord Fisher by Sir Corbet Woodall, on Dec. 30 last, called the attention of the First Sea Lord to the difficulty experienced by the Gas Companies of London in obtaining adequate supplies of coal, and further to the gravity of the situation if the gas service should fail. This letter received very prompt attention; and the matter was referred to the Oversea Prize Disposal Committee presided over by Vice-Admiral Sir Edmond J. W. Slade, K.C.I.E. This Committee invited representatives of the gas and other companies and authorities providing the public services in London—gas, electricity, water, docks, tramways, &c.—as well as leading coal merchants engaged in such supplies to form a Committee. This was done; and communications were opened with the Board of Trade.

As a result, certain German boats detained in British ports at the outbreak of war were released, and placed at the disposal of the Committee, which is known as the London Coal Supply Advisory Committee. So far well. But when the freight to be paid for these boats had to be determined, the Board of Trade insisted upon receiving the rate paid in the open market, which is now about 13s. 6d. per ton. The Advisory Committee called attention to the fact that, when the Admiralty commandeered the vast number of ships needed at the outbreak of war, they fixed the rate of freight to be paid to the owners at about 4s. per ton. It was the withdrawal of these ships which caused the present famine prices to be paid for those remaining in the hands of the owners; and it is felt to be most unreasonable that the help now accorded should be accompanied by a condition which renders such help of practically no avail. To pay a price of 13s. 6d. per ton, or more than 10s. above the rate at which contracts were made last June, would necessitate an increase in the price of gas so large as to be ruinous. It would seem the only parties to gain by this action will be the Government, to the extent of the profit earned over the cost of running, and the owners of free ships, whose gains are now colossal.

The issue from this difficult position (in regard to which it will be seen that all it is possible to do has been done by the Committee) will be anxiously looked for. Meanwhile, we may quote a letter which was circulated on Friday last among the companies, authorities, and merchants concerned, by the Admiralty Coasting Trade Office, and which more particularly explains the present position:

> The Admiralty have requisitioned a certain number of detained enemy vessels to be used, primarily, for the carriage of coal to London. It is hoped by this means to give such assistance as will prevent any public utility Company in London being starved for want of fuel. But since there are only a few boats, the assistance can only be of a limited nature; and it must be clearly understood that you must take every precaution, and use every means, to secure your requirements independently of Government help.
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> A Committee has been formed, with Mr. D. Milne Watson, of the Gas Light and Coke Company, Horseferry Road, Westminster, S.W., as Chairman, to represent the coal interests of London. Applications for tonnage should be made through Mr. Watson's Committee, who will send their recommendations on to me. The name of this Committee is the London Coal Supply Advisory Committee.
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> As it is desirable that this office should understand something of your ordinary arrangements for supplies, and also keep in touch with your position, I enclose: (*a*) Two forms marked "A," which please fill up, returning one to me as soon as possible, keeping the other for your file. (*b*) Twenty-four forms marked "B." These will last for twelve weeks. Please make your first return up to Friday morning, the 22nd inst., and let me have it as soon as possible. Subsequent returns should be made up on Fridays, and reach me not later than the first post on Mondays. The additional twelve forms will furnish your office copies.

An Embargo upon Capital Issues.

A SHORT time since, when discussing in these columns the question of capital issues by gas companies during the continuance of the war, reference was made to the point that the conditions that would be produced in the Money Market through war loans and other national requirement, as well as through the capitalizing of new industry and the enlarged needs of existing industry, would without doubt lead to such stringency and competition for capital that everything possible should be done to see that the attractions of existing gas stocks were only depreciated to the minimum degree. The regulations that were promulgated last week by the Treasury in regard to new capital issues during the war—the wisdom of which in the national interests is generally conceded—will, we think, have advantages for gas companies who desire in the immediate future to supplement their capital. Those so requiring further capital will perhaps experience the inconvenience of delay, unless they look well ahead, in getting the sanction of the Treasury (as they will have to do) before making fresh issues. But advantages created by the regulations under current and prospective war circumstances in respect of finance will undoubtedly be reaped by old-established and solid home undertakings such as those concerned in gas supply. The main view of the Treasury in making the regulations is, of course, to husband the resources of the country with a view to the successful prosecution of the war; and it is only right that all else should be subordinated to this paramount necessity of the country.

The first regulation compels all persons or undertakings proposing to make fresh issues of capital to obtain the approval of the Treasury before doing so; and it is intimated that it must be shown to the satisfaction of the Treasury that the issues are advisable in the national interest. The term "national" connotes something extensive and large; but, in the present circumstances, one has no certainty as to what will be comprised within its limits. It may be taken for granted that the public are included within them, and that there will be no difficulty, other than possibly that of time, in securing the sanction of the Treasury to issues for the purposes of gas supply to the community. As a matter of fact, it may be pretty safely assumed that there will be no vetoing of issues that obviously will be of benefit to home undertakings and trade; and when approval of the Treasury has been obtained, the fact should have value in placing issues among investors.

There is no question that, in this scheme for conserving our financial resources, the Treasury has its eye particularly on two outlets for capital, which they intend to temporarily block—the flotation of new and not immediately pressing concerns, and capital exportation. The next two regulations deal with the latter outlet. Unless satisfaction can be given that urgent necessity and some special circumstances exist, even the issue of capital for the British Empire overseas will not be permitted; and, under no circumstances, will issues be allowed for undertakings to be carried on outside the British Empire. This will effectually prevent the exportation of capital which has been going on fairly vigorously the last few years—chiefly owing to the heavy burdens of taxation in this country, and to the higher returns that are realizable by many foreign investments. But with the stoppage of the outflow of capital from these shores, investors who have been finding employment for their surplus cash abroad will again have their attention diverted to the sound concerns at home. This being so, and with the absence of new promotions, the old-established home securities should benefit, and among them those of gas undertakings. The final announcement in the Treasury regulations is that, in ordinary cases, there will not be insistence upon the restrictions where issues are required for the renewal of Treasury bills or other short-term instruments held here, and falling due, of foreign or colonial governments or municipal corporations, or railway or other under-

takings. The grounds for this liberty, of course, are that this does not actually mean the raising of fresh capital, and that, if renewals were not allowed, then those in possession of the bills or other short-term instruments would be in a worse position.

On the whole, in financial circles the new regulations are regarded with perfect equanimity, as being a necessity in the national crisis. Of course, the right of the Treasury to a veto on new issues will only continue in force as long as military exigencies render this necessary. Meanwhile, in view of this cessation in our foreign financing, America is hoping to be a considerable gainer. That country will need to "make hay while the sun shines;" for the credit of Great Britain stands high in foreign countries, and once the present embargo is removed, it will in this respect enter into its own again.

Ilford Electrical Illegalities.

After the Long Eaton undue preference case, came the South London one, and now the Ilford—the worst of all. It stands to the credit of the Ilford Gas Company that they were instrumental in bringing the District Council to see the errors of their ways—for there were in this instance more ways of illegality than one. The Council have not only been showing undue preference to all classes of consumers who boycotted other methods of lighting and patronized only electricity, but they have been carrying on trading and hiring in electrical appliances, and have been devoting money to these purposes, without any authority whatever for so doing. The Gas Company applied for a series of declarations that the Council were doing wrong, and for an injunction to restrain them from continuing to commit the acts of which complaint was made.

The matter came before Mr. Justice Sargant last Wednesday; and the only point then arising for argument—the Council having been persuaded, by the course of recent events and wiser intellect than their own on such questions, as to their plural infraction of the law—was the length of time, if any, which should elapse before the Gas Company could apply for an injunction against the Council in the event of their continuing the acts upon which they had submitted to the declarations. Ilford is not a remarkably large place; and it seems to us the Gas Company acted with generosity in suggesting that the Council should have three months' grace, during which period no injunction should be applied for. The Council, however, wanted twelve months. Now it follows that, as the illegalities were the subjects of agreements with a duration of anything from one to five years, the tying of the hands of the Gas Company for twelve months would have given the Council such abundant breathing time that some of the agreements would in the meantime have run out. The submission of the Council was that they wanted time within which they could bargain for the sale to the users of the existing electrical apparatus out on hire. Such sale, of course, would also be *ultra vires;* but the Council did not seem at all disposed to trust the Gas Company to act reasonably in the matter. They themselves have been guilty of acting not only unreasonably but illegally—illegally in connection with preferential charges with the express intention of doing the maximum possible injury to the Gas Company. It therefore came with very poor point from Mr. Martelli, for the District Council, when he remarked that "as we cannot get any mercy from plaintiffs, we have to make the best terms we can." In other words, there was the suggestion of vindictiveness from those who had themselves acted vindictively in their trading methods towards the Gas Company. Not only were the Council anxious to gain time, but there is another trouble before them, and that is the question of surcharge which the Local Government Board will doubtless make in connection with expenditure for purposes that are *ultra vires.* This being so, the Council are anxious to recoup all the money they can, by selling to the users the apparatus on hire. Mr. Justice Sargant gave them one point—and only one—for satisfaction. It was that, in respect of existing apparatus out on hire, he would not take the sale by the Council to the user as sufficient ground for granting an injunction. In the result, his Lordship made the necessary declarations, and granted open liberty to the Gas Company to apply for an injunction; and the Council are to bear the costs of the case. The Council did not gain anything by the discussion in Court, beyond the pronouncement by his Lordship as to what would occur in the event of an application for an injunction merely on the ground of the Council disposing by sale to the user of an existing piece of electrical apparatus.

All this illegality and irregularity in the conduct of the electricity supply business does not stand to the credit of the administrations guilty of such acts. If they have been in ignorance committing these contraventions of the law, then this does not say much for their competence and sense of responsibility in carrying on such a business. In this instance, we have a Council who have exceeded in two directions the powers possessed by them; and, even after the Long Eaton judgment in respect of preferential charges, and with before them the prior Sheffield and Leicester cases in respect of dealings in electrical fittings and apparatus, they stood out obstinately in defence of their law-breaking policy. Not only so, but there was circularizing (we do not know whether this was with the consent of the Council) of local authorities by the Incorporated Municipal Electrical Association for subscriptions for the maintenance of this action, in order that the Council might indulge to the full in the foolishness of trying to uphold the pursuit of their irregularities. All this resistance notwithstanding, we see the Council utterly crumpled-up, and confessing to the truth of the whole gamut of charges. While the history of this Ilford matter is interesting, it is not publicly edifying. Such cases do not assist in giving strength to public confidence in local government, or rather in the local administration of trading enterprise. Our local councillors should, at any rate, be law-abiding. It should also be beneath the dignity of such councillors to go deliberately out of their way to pursue a policy not in accord with either commercial principles or statutory obligation, and pointedly directed to the injury of a trade competitor, and that competitor representing private enterprise, and being a substantial ratepayer. To use municipal privileges, power, and influences to such ends does not redound in any way to the credit of the participants.

Professor Lewes Splits the Difference.

Time was when the managers of gas undertakings produced coke, sold it according to the ups and downs of the market, took its production and sale philosophically as a matter of course, and said very little about this principal of secondary commodities, either in open discussion or through the technical journals. All this has changed the last few years. Coke, in its physical, qualitative, and commercial aspects, is in the industry one of the popular subjects of the day. The partial loss of certain coke markets, and the bearing on coke utilization in gas making of the vagaries of the oil market, have compelled close attention to the consideration of the development of new markets, and to what must be done to make coke acceptable for, and to win way in, new applications. Consideration has been given to its grading according to the purpose of its use, to the selection of coal for gas production which will not leave an undue percentage of ash concentrated in the coke, to the question of its quenching so as not to leave a large percentage of moisture in it, to its handling after it leaves the retorts in order to preserve it from undue reduction, and, at one gas-works at any rate, protection has been given to stock from atmospheric influences. There are gas managers, too, who are deliberately operating to produce a variety of coke to suit the local markets—even to the production of metallurgical coke. All this is having effect. At the moment, the accumulations of stock at gas-works are being exhausted through conditions that fortunately are only temporary—coal delivery shortage, and large use of water-gas plants; and gas-works' managers know full well that the normal conditions of pre-war and after-war times in connection with the disposal of coke are the ones which they have to work to meet. There is consequently no relaxing of efforts, and there has been encouraging success (as experiences related in our columns have testified) in cultivating the greater use of coke for steam-raising, for water-heating in large quantities, and for the domestic grate.

But Professor Lewes holds up a monitory finger. He has done so before, and on more than one occasion. He did so again, when the members of the London and Southern Junior Gas Association succeeded in getting him to occupy their platform last Friday evening, and give them a delectable lecture on, superficially regarded, such an indelectable subject as coke. Professor Lewes once had a precipitate fall from his professions of faith in the carbonizing practices of the gas industry; and he was suddenly found standing as

far from these practices as he could place himself—a lonely revivalist and apostle of ancient doctrines. He wanted the gas industry to retrace their steps to almost the beginning of things in coal carbonization, to forsake the path that had given them such great commercial prosperity, and all in the cause of coke. Not only was the balance-sheet against him, but for the promised land for coke of greater richness in volatile constituents—the promised land of myriads of domestic grates—he could show no substantial guarantees to justify his then revolutionary proposals, nor did the experiences of the Gas Light and Coke Company in the matter of the public acceptance of a coke containing a higher percentage of volatile matter support the new preaching. The monitory finger still shakes. We are warned that the day of cheap coal has gone, never to return. This is a common belief in the gas industry. But "this means that, unless a "reconsideration of the position leads to the adoption of "new methods, and drags the industry out of the ruts in "which it has crystallized, there is nothing to look forward "to in the way of cheapening gas" . . . and "increase "in price [of gas] will become imperative, and seriously "check its advance for fuel purposes." A little later on, however, in his last week's lecture it would appear that the "crystallization" in "ruts" is not of a continuing order. For when the industry was engaged in murdering and ruining its bye-products, in the "insane" desire to increase the yield of gas, the vertical retort and heavier charges in horizontal retorts came to relieve the situation, and gas, tar, and sulphate of ammonia production improved, while coke was also slightly bettered. Therefore, it comes to this, that the gas industry has improved its products somewhat, and is getting what Professor Lewes desires it should get, greater value than before from a ton of coal, by the newer methods without having had to adopt his old-time advice to take an extreme course in falling back upon working low-temperature carbonization.

So far, so good. There is confession now on Professor Lewes's part that, if the old advice had been taken, the gas industry would have simply committed suicide. Even now, however, he is not satisfied with what the industry has done; and he puts forward anew his old case in a modified form. With the modification, the case is one worth serious consideration, with the one prefatory remark that he still does not show that what he proposes will give greater prosperity than current practices and the commercial lines that are now being developed, nor is he able beyond his own words to produce assurances that all factors necessary to his case will mature and remain constant. There is one thing the industry's monitor can claim; and it is that the very actions of the industry to-day in giving greater heed to the character of the coke it offers to the public for various uses indicate an awakening to requirement. They indicate, too, that the industry is quite alive to the need existing for obtaining and maintaining fresh markets for coke; and this gives a measure of endorsement to the Professor's view that "coke will "in the future be the salvation of the industry." But it is manifest that our friend entertains a very poor opinion as to the way the industry has set to work to this end. Leading up to the kernel of the lecture, and, as it were in an aside, he cries: "Show me the works where the make of "gas per ton averages over 12,000 cubic feet, and I will "show you the district where coke has only a low sale." It is a sweeping and a difficult request, inasmuch as the Board of Trade returns for 1912-13 assert an average production for the whole of the statutory gas enterprise of the United Kingdom of 11,733 cubic feet per ton of coal carbonized, which testifies to a very considerable production above the 12,000 cubic feet line, and is evidence that Professor Lewes believes he has the simple and single key in his possession to the cause of the recent slump in coke, and of the huge coke stocks to be found recently in all parts of the kingdom. It stands against his argument that the causes of this condition of affairs are traceable more to loss of markets through new developments in other industries and to competition from other coke producers, as well as to the price of oil in connection with carburetted water-gas manufacture, than to the loss of a domestic market that the gas industry has never thoroughly and deliberately directly cultivated. There is no analogy, such as Professor Lewes would set up, between the domestic market for gas coke and the metallurgical market for the coke-oven. He says that the "coke-oven manager, by providing the class of coke wanted "for metallurgical work, commands 50 per cent. higher "prices than can be obtained for gas coke." The 50 per cent. is not in accord with published statements of a few months since. But let that pass. Metallurgical coke must be had by those who use it. It has no competitor. The householder need not have gas coke, whatever its quality, if other fuel competitors please him or suit his pocket better. It is so easy to say, and even to put a confident ring in the prediction, that "a year's work with a good quality of coke "would give a demand that could not be satisfied, and at a "price only 2s. to 3s. below that of coal." The proof of this is not in mere words; and the practical experience of the Gas Light and Coke Company certainly did not produce confirmation.

However, Professor Lewes has with time passed from the extreme in this matter to moderation. He has got nearer—much nearer—to his old home. We welcome the close return of the prodigal. He is not alone in the gas industry in the views which he now expresses; and it is just as likely as any other happening that the position he now occupies is the one to which there may be a considerable tendency. In days past—in the days of his isolation in this regard, some six or seven years ago—our friend would have had the industry carbonize at about 400° to 500° C., and leave in the coke about 10 per cent. of volatile matter—compensating the shortage of gas by the use of a considerable proportion of blue water gas. But what would have happened? Experience has told us; and Professor Lewes himself lifts, in this lecture, the veil that has been left as much as possible over that experience. The coke produced at those temperatures, and with its 10 per cent. or so of volatile matter, was so tender and soft that it would not stand handling, and in transit it crumbled up into an excessive amount of small. Furthermore, there would have been a loss of sulphate of ammonia. Therefore, Professor Lewes, in those days, was only asking the gas industry to leave, as he would expressively put it, one road to ruin to pursue another. But the position to-day is more rational, more comprehensible. Carbonize at 900° to 1000° C. (1050° C. is the temperature suggested), produce a coke containing only from 4 to 5 per cent. of volatile matter, be content with 10,000 cubic feet of a 18·5-candle, or 680 B.Th.U., coal gas per ton, add to this 5000 cubic feet of blue water gas of 320 B.Th.U., and so obtain 15,000 cubic feet of a mixture having a thermal value of 560 B.Th.U. This, in brief, is the proposal; and there one has more gas for sale, a quality of coke that will capture the domestic market, *plus* the quality of tar that is much required to-day, and the maximum production of sulphate of ammonia, seeing that at temperatures above 1000° C. there is decomposition of ammonia, and below 900° C. there is a falling off in its production. So Professor Lewes splits the difference between the old extremist low-temperature views once entertained by him and the current practices of gas makers. So (mainly through the improved domestic coke) the fortunes of the gas industry are to be advanced. And it happens that he will find far more sympathizers with his present position, because there are already many men in the gas industry who believe that, with a thermal standard for gas, what is here suggested points the road to larger developments, to bye-products of higher value, and to a release (through blue water-gas manufacture, as well as through the domestic market) from, as things are in normal times, the commercial trouble of an unceasing enlargement of coke production.

Gas Oil and Other Oil Imports.

How fared the petroleum trade in England during 1914? The question has greater interest than usual, in view of the war, and the large dependence of this country upon foreign sources of supply. In the commercial oil situation, the gas industry has large concern—not only as considerable buyers for carburetted water-gas manufacture and lubricating purposes, but on account of the competition of oil as an illuminant and for motive power, and the competition of imported spirit with home-produced benzol for motor-car use. A retrospect of the petroleum trade during last year has been published by the "Petroleum Review;" and it makes instructive reading. Far from the war having adversely interfered with the petroleum trade in this country, it appears to have beneficially affected it. Last year, our contemporary states, we imported no less than 459,744,780 gallons of various petroleum products, which quantity is exclusive of the large amounts absorbed by the British Government, which may be calculated to aggregate about 200 million gallons. The European war has,

of course, interrupted supplies from certain eastward fields. Owing to this fact, owing also to important Continental countries being closed to outside trade, America has taken advantage of its free way to this country, and has made the most of its opportunity; and it is easy to agree with our contemporary that, had it not been for the amplitude of the American supplies, this country long ere this would have been in a very unfortunate position. The gas oil trade is now almost exclusively with America; and there is indication of the large revival of carburetted water-gas manufacture, after the shutting-down of plants, due to oil costs, in 1912 and the first part of 1913, when it is learned that the gas and solar oil imports from America last year established a new record—amounting in the aggregate to 83 million gallons. This figure is in the neighbourhood of 20 millions in excess of the total for 1912, and 18 millions in excess of the total for 1913. Notwithstanding the growth of the prepayment gas-meter system, the illuminating oil trade has still very large proportions, though the constant inroads upon it are causing its bulk to gradually dwindle. When one sees that the imports of illuminating oil during the past twelve months amounted to 146,600,000 gallons (which was some 10 millions less than in 1913), it suggests that (not forgetting the use of oil for illumination in other directions) the prepayment gas-meter has still quite an extensive field to conquer. Our contemporary admits that during recent years the tendency has been to a diminished consumption of oil for illuminating purposes. "But now that kero-"sene can be so advantageously employed for heating and "cooking purposes, combined with the fact that its use as "an illuminant under modern conditions is now regaining "favour, there is no doubt that a steady increase will be "shown in the illuminating oil imports for many years to "come." There is good confidence in saying that such a messy method as cooking and heating by oil will not gain much headway with cleanly, convenient, labour-saving, and economical gas opposing. Of course, there is an increasing use of oil for internal combustion engines. Motor spirit imports also showed an enormous gain during the past year. Altogether 120 million gallons were imported, or about 18 millions more than in 1913. So long as the gas industry continues to make headway, it can afford to congratulate a companion industry upon its successes, even though that industry may be largely competitive.

Shop-Lamp Payments and Lighting Prohibition.

It is against human nature to find pleasure in paying for goods, services, or anything else that one has not had. But one must be reasonable in deciding what is fair and what is unfair in regard to normal obligations when they are brought, through the fault of no one directly concerned, under the influence of abnormal circumstances. It was seen in our "Miscellaneous News" last week, that some of the tradesmen in South London are discontented with the charges that the South Metropolitan Gas Company are proposing to make, during the period of inhibited lighting, for the contract high-pressure gas-lamps used for outside shop lighting. Other tradesmen are of opinion that the Company are dealing with them in a very fair way. It was an anticipation that was positive in its realization that there would be contrary opinions among one party to the lamp contracts as to the fairness or otherwise of what the other party proposed in regard to payment. The only party that was in a position to propose a *modus vivendi*, to carry over the non-lighting period, was, of course, the party to the contract that was unable to fulfil its terms to the final letter owing to the intervention of, and compulsory submission to, higher authority. But it seems to us that it would have been a good thing, and would have assisted in avoiding or moderating any discontent, if there could have been some general agreement among the suppliers of contract shop lamps under the unparalleled circumstances. As it is, we find the policy in this matter of even neighbouring gas undertakings is not the same; and the lines taken by suppliers of electricity are also different. Of course, it is easy to understand that circumstances differ; but they surely do not differ so much that some general procedure in this connection could not be resolved upon. What is the result? Heard in meetings of Tradesmen's Associations and in Council Chambers, where discontent in this regard would probably not have entered had there been a general arrangement, is comparison of the different procedure in adjoining districts; and naturally the greater the extent of the relief of the tradesmen from their obligations under their contracts, the greater in their view is the fairness meted out to them by the gas or electricity suppliers.

The variations that exist in the lines of treatment in respect of these charges are about as diverse as they could possibly be. The Gas Light and Coke Company, it is reported, are making no charge for the outside high-pressure lamps supplied at a rental; while the South Metropolitan Gas Company are charging half the usual amount for rent and maintenance. Some of the electricity suppliers are only charging for a weekly clean of the arc lamps out on hire for illuminating shop exteriors; the lamps thus being kept in order ready for immediate use on release being given by the authorities, which as things are going—with the uncertainty of air raids and slaughtering by the Germans of defenceless civilians, including women and children—is not likely to happen until the establishment of peace puts an end to further barbarous deeds such as have been lately experienced on the east coast. In the case of the Fulham electricity undertaking, the charge to the tradesmen is to be at the rate of 500 hours per annum use, to cover unavoidable outgoings in connection with the lamps. The Marylebone Borough Council—the Electricity Department being anxious not to forego under their circumstances a single penny of their revenue upon which hands can be laid—some little time ago (we do not know whether they have since receded from the position) notified the tradesmen with electric-lamps on hire that the terms of the contract must be adhered to. This is going the utmost length, and is unfair.

But speaking generally, tradesmen seem to forget that, being parties to contracts for outside lamps, there are obligations on their side as well as on that of the other parties. The latter, in the case of gas, have provided at considerable expense the high-pressure system; and there are the installed lamps, which have to be maintained, cleaned, and kept in repair. In the present lighting circumstances arising out of the national crisis, there is only failure in one respect on the part of the suppliers in complying with the contractual conditions, and that is, through the intervention of the custodians of public safety, the lamps are not lighted up. This being so, it seems to us that the terms of charge suggested by the South Metropolitan Gas Company for the lamps during the inhibited lighting period are quite fair. It was stated at one meeting of a Tradesmen's Association that, in round figures, some £70,000 has been expended on the extensive high-pressure supply systems in South London. There are the continuing capital charges upon this expenditure. Compressing plant and stations have to be kept in running order; lamps have to be maintained and cleaned. All the capital expenditure and all the provision that has been made for this high-power lighting have served the shopkeepers in normal times. Abnormal times do not destroy, or suspend, the charges incident to the capital expenditure and provision, and the protection of what the capital represents. It still exists, and the charges continue. So do those for attendant labour and maintenance. There is only the unconsumed gas that is saved. In these circumstances, we cannot think any fair-minded man can regard as exorbitant the proposal to charge half the usual amount for rent and maintenance during the period of the official interdict of outside shop lighting.

In connection with the charges for partial street lighting, much the same conditions obtain. Extinguished lamps have to be maintained, just as though they are in use—in fact, in some districts the lamps lighted are varied from time to time. The man who lights, extinguishes, cleans, and adjusts the lamps has to pass over the same ground as when there is normal lighting. Really nothing is saved, other than the unconsumed gas. In the case of the South Metropolitan Gas Company, they are deducting from the public lighting accounts the value of the gas unconsumed. Some local authorities think this is not liberal enough; others are of opinion that it is generous treatment. In a matter of this kind, whatever was done it would be impossible to realize a common view among local authorities with their composite membership. What is being done by the South Metropolitan Company is very generous compared with the treatment of ratepayers in some districts where the electricity concerns are in the hands of the local authorities. For example, the Marylebone and the Battersea Electricity Committees—there are doubtless several others—have both pleaded for, and we believe the Councils have assented to, the terms of the public electric lighting contracts being adhered to. The Committees urge that they are losing business

through the reduced shop lighting, and that therefore it would be very hard if they also lost any part of the revenue from public lighting. Imagine a gas company or an electricity company putting forward the same argument, and preferring the same claim. Borough councils and ratepayers might in the first place treat the matter in a good-natured spirit as a "try-on," but their resistance to a piece of imposition in respect of a matter in which, under the circumstances, there should be mutual concession would be of a very resolute order. But borough councils running electricity undertakings are not of the same genus as private companies, and they do not acknowledge obedience to the same principles in regard to their commercial conduct.

Sulphate of Ammonia Output.

In commenting last week on the review of Messrs. Bradbury and Hirsch regarding the course of the sulphate of ammonia market during 1914, reference was omitted to the estimate of the year's production in the United Kingdom. Owing to different causes associated with the twelve months—the war, the reduced demand for metallurgical coke, and the greater recourse to carburetted water-gas manufacture, due to the reduced price of oil and the plethora of surplus coke—it was calculated that the total output was 421,000 tons of sulphate of ammonia, or 11,000 tons less than the year preceding. Of this reduction, it was reckoned that gas-works were responsible for 5000 tons (with a production of 177,000 tons), coke and carbonizing works and producer gas for 4000 tons (with a production of 163,000 tons), iron-works for 1000 tons (with a production of 19,000 tons), and shale-works also for 1000 tons (with a production of 62,000 tons). While not at the moment prepared to positively dispute the correctness of the estimates, we are at a loss to understand why Messrs. Bradbury and Hirsch should compute the considerable drop of 5000 tons for gas-works. We do not believe that, taking the aggregate for the country, it will be found that there has been any considerable recession in the gas consumption for the twelve months. Assuming the average figure of 25 lbs. of sulphate per ton of coal carbonized, or 90 tons of coal carbonized per ton of sulphate produced, the suggested reduction of make represents in round numbers 450,000 tons of coal. We certainly doubt that the year, compared with 1913, saw any such reduction in the quantity of coal carbonized—war lighting conditions and carburetted water-gas manufacture notwithstanding. Time will show.

The National Dye Scheme.

While the industries depending upon synthetic dyes and colours are drifting into a serious position owing to the insufficiency of supplies, everything possible is being done by these very users to prevent the Government scheme going forward. The fact that the scheme does not provide in stated terms for security in the future against German competition is the main obstacle; and it is rather a strange thing that protection is advocated, and most strongly, from the very counties where to speak of protection in other times meant anathema. We cannot understand the necessity of any protection stronger than the new company being capitalized and run by the dye users themselves. Although two members representing the users have retired from the Committee who have in hand the Government scheme, there is going to be no abandoning of the project at this juncture without trying to find a way out of the difficulty. The Committee are to be reinforced, and the work is to be taken in hand of trying to modify the scheme, so as to make it more advantageous, and so more acceptable, from the point of view of the subscribers. It would be a thousand pities, and an eternal loss, to miss this never-to-recur opportunity of establishing here the aniline dye industry to an extent at any rate sufficient for the needs of the country. Meanwhile, America is not making so much fuss about setting to work; and a large company is being promoted, centred in Philadelphia, to take over a considerable part of Germany's dye and colour business. It may be that America will out of this gain enormously where we shall lose owing to existing destructive dissension. It is a matter for note that Professor Meldola is of opinion that the Government scheme will not be a success owing to the absence from its constitution of a sufficient representation of the scientific element. If the Company is formed, it can well meet the defect by appointments and respectable salaries.

Freights and Coal.

With the cold, dark weather experienced last week, the coal situation for consumers well removed from the coal-fields became still more serious. The London and Southern Gas Companies in particular are feeling very keenly the position in respect of freights; but as will be seen from our first editorial article, there is no hope of relief through the use of detained enemy ships, and much injustice is being done in this regard to those concerns whose ships have already been commandeered. Speaking generally, freights have not been anything approaching present figures since the shipping boom of 1912-13. Whereas not long ago, freights from the Tyne to London were about 3s. per ton, they are now 13s. 6d., which is a serious matter when cheap gas is badly wanted. On *coal* gas the increase in freights means (as is pointed out in the circular of the South Metropolitan Gas Company reprinted elsewhere to-day) an addition of about 9d. per 1000 cubic feet. But gas companies who are operating at a distance from their directorial base—such as some of the South American companies—are in worse case, and are paying enormous figures. River Plate freights, for instance, are quoted at 65s. and 67s. 6d. per ton, as against 10s. and 11s. 6d. per ton a year ago. Insurance, coal, material, and working expenses are heavier, and delays *en route* (also due to Admiralty restrictions and dangers created by the war) cause expenses to mount up. Freights, railway congestion, and cartage have had a bad effect also on the price of household coals. To make the weight of reason heavier for the higher prices, it is stated that there is a shortage of output at the pits due to the number of miners who have joined the colours. Up North, however, there appears to be quite a fair amount of coal, largely owing to the reduced export. Household coals are being sold in London chiefly at from 28s. to 32s. per ton; the poorer qualities running down to 25s. In small lots the poor are paying at the rate of 33s. to about 37s. per ton. This is bad for them in these times, when dearer living generally is being severely felt by the smaller weekly incomes. The high prices of domestic coal are having a beneficial effect on coke and gas sales.

For Business Government.

In quieter times, when there was leisure to devote to the consideration of what might be termed the domestic affairs of the country, the need was more or less realized for something in the nature of a "Business Government." As a move in the desired direction, there was formed about three years ago the Employers' Parliamentary Association, whose aim was to secure consultation by Parliamentary Committees with business men through the medium of the Association before legislation affecting industry is placed upon the Statute-Book. During its short existence, numerous questions have come before the Association—such as national insurance and the carriage of goods on railways. Recently, however, such topics have given place to others of even wider significance. Consideration has had to be given to the subject of trading with the enemy, and to that of the supply of aniline dyes; but the Association has proved equal to the demands made upon it. The feeling is entertained that much assistance in reaching the goal for the attainment of which the organization was formed will result from the fact that some time ago the Central Executive Committee were requested by the Commercial Committee of the House of Commons to appoint delegates to consider what joint action could be taken on questions in which the two bodies were interested. This Commercial Committee of the House of Commons, it may be mentioned, is claimed to be entirely non-party, inasmuch as "it has a membership of 200, drawn from all parties and associations for the purpose of promoting the interests of all sections of the commercial, industrial, and business community of the country." There has been brought into membership of the Association no fewer than forty federations and associations of employers, and many large employers in certain special industries, who otherwise had no means of dealing collectively with legislative matters affecting industry generally. A point that is worth noting by any who may be contemplating joining the Association is the fact that the Central Executive Committee, in view of the many and intricate problems which frequently present themselves to the manufacturing community on questions of rating and Imperial Taxation, and which demand for their satisfactory solution experienced and expert advice, have appointed Messrs. Humphreys-Davies and Co. as valuers and surveyors to the Association.

PERSONAL.

The new Director on the Board of the Commercial Gas Company in place of the late Mr. Walter Hunter is Mr. T. F. V. BUXTON.

Mr. THOMAS SETTLE, of Exeter, whose name is well known to "JOURNAL" readers in connection with the vertical retort with which it is associated, has been elected a Fellow of the Institute of Inventors. Mr. Settle's work on the carbonization of coal in both horizontal and vertical retorts has extended over many years; and he has been concerned with patents taken out for no less than twenty-six countries besides Great Britain.

Mr. CYRIL TOWERS, who for eight years has been Engineer and Manager of the Brentwood Gas-Works, is leaving next week to take up his duties in a similar position connected with the Hythe and Sandgate Gas Company. On Wednesday last, Mr. Towers was the recipient of a handsome silver tray and an illuminated address, bearing the names of the 53 members of the office staff and works employees who had subscribed towards the gift. Mr. A. E. Johnson (the Secretary) made the presentation, and voiced the esteem in which Mr. Towers was held, and the wishes of the subscribers for his future success and happiness. Mr. Towers, responding, asked that his successor should be given the same loyalty as he had always received from the staff. Since Mr. Towers took over the management at Brentwood, the production has increased by 20 million cubic feet; the cost to ordinary consumers has been reduced by 2d. per 1000 feet; and the dividends have risen from 8 to 10 per cent. This is a good record. Mr. H. D. LUMB, of Chard, is the new Manager at Brentwood.

OBITUARY.

Mr. JAMES BYRNE, J.P., of Clonmel, whose death is announced, was formerly Chairman of the Corporation Water Committee, and was largely responsible for the carrying out of the scheme which gave the town an excellent water supply.

The death occurred on the 16th inst., at the advanced age of eighty-five, of Mr. EDWARD WRIGHT, the Chairman of the Leamington Priors Gas Company. Deceased was a solicitor by profession. He became a Director of the Company in 1867, was appointed Chairman in 1894, and held the position till his death. His chief occupation was the Company, whose success was in great measure due to his business acumen. The funeral took place last Wednesday; among the mourners being Mr. Thomas Berridge, J.P., the Managing-Director of the Company.

A cablegram has been received by the Colonial Gas Association, Limited, from Mr. P. C. Holmes Hunt (the Chairman of the Association's Local Board in Australia), announcing the death last Wednesday week, the 13th inst., from pneumonia, of Mr. WILLIAM SWINBURNE, the Managing-Director of the Association. Deceased had been for many years actively connected with the management of the undertaking in Australia; and on the retirement of his brother, the Hon. George Swinburne (to become one of the Interstate Commissioners), Mr. William Swinburne was appointed Managing-Director.

THE GAS INDUSTRY AND THE WAR.

The names are published of 34 enemy ships detained in United Kingdom ports at the outbreak of war which "The Times" understands the Admiralty propose to put into the East Coast coal trade, with a view to relieving the situation caused by the short supply of tonnage, the delays in port, and the consequent difficulty of getting coals into London. The method of using the steamers is, however, it seems, being subjected to some little criticism. Our contemporary explains that recently "conferences were held between the Admiralty and the interested bodies, such as the gas and electricity companies and the coal merchants, and it was then suggested that the enemy steamers should be apportioned, at rates to be agreed upon, to the public service companies according to their needs, and to the shipping companies in proportion to the numbers which had been acquired by the Government. This plan, however, has not been adopted. The steamers seemingly are to be put into the open market under the management of firms at Newcastle, and will apparently all be chartered to the highest bidders. As compared with the low rates of 2s. 9d. or 3s. per ton quoted before the war, a freight of 13s. 9d. is now current. The placing of the vessels in the open market may possibly have the effect of causing rates to become easier; but there is a feeling in certain interested quarters that a more effective method of using the vessels to the best advantage of the public would have been to distribute them according to the needs of the great public service companies. On the other hand, there can now be no question of privilege, since all will have the opportunity of chartering them. Certain of the gas companies are believed to have supplies for only about ten days; and additional steamers are badly needed."

"Alarming Outlook in Regard to London's Coal Supply" is the heading of a leaflet sent out by the South Metropolitan Gas Company to their consumers. It will be seen from p. 211 of this issue, that the subject dealt with is one in which the customers have a direct interest.

A further step in the direction of arriving at a solution of the problems connected with the national dyeware scheme was taken last Wednesday, when the conference on the subject of the Committee appointed by the users of dyes [referred to in the "JOURNAL" a week ago] was resumed. Two members withdrew from the Committee, in view of the present attitude of their respective companies towards the scheme; and the remaining members unanimously expressed themselves as being of the opinion that proposals put forward by the Bradford Dyers' Association were impracticable. The Committee will, it has been notified, be enlarged, and will proceed immediately to the preparation of a scheme on a modified financial scale, which, while not departing from the general lines originally laid down, will in several respects be more advantageous to the subscribers to the proposed Company.

The supply of coal tar in Russia has, says a Petrograd correspondent, become a very acute question since frontier communications between Germany and that country have been closed. The only gas-works that hitherto has made a feature of distilling its own coal tar for chemical purposes to any extent has been that of Warsaw. Moscow had realized the importance of directly utilizing the residuals of gas production, and had entered into a contract with a German house to supply a plant for the recovery of ammonia. But difficulties having supervened in consequence of the war, there is said to be a probability that, in the event of some home house not being found capable of carrying out the work, the contract will ultimately be confided to a firm in England or in a country on friendly terms with Russia. A good deal more coal tar could be obtained by the Russian gas-works, were the industry more alive to the value of using up the raw material that lies close at hand. But hitherto either the raw material itself or its derivatives—such as aniline dyes—have been obtained almost entirely from Germany. The present crisis is forcing attention to what the gas-works can do for the country; and it is believed the result will be a much larger call on these establishments for coal tar and other bye-products of value in the chemical industry.

On Monday of last week, the following announcement with regard to the issue of new capital during the continuance of the war was published by the Treasury:—

> In connection with the re-opening of Stock Exchanges, the Treasury have had under consideration the general conditions under which new issues of capital in the United Kingdom can be permitted during the continuance of the war. It appears to the Treasury that in the present crisis all other considerations must be subordinated to the paramount necessity of husbanding the financial resources of the country, with a view to the successful prosecution of the war.
>
> Accordingly, they wish it to be understood that, until further notice, they feel it imperative, in the national interest, that fresh issues of capital shall be approved by the Treasury before they are made. The Treasury approval would be governed by the following general conditions:—
>
> (1) Issues for undertakings carried on or to be carried on in the United Kingdom shall only be allowed where it is shown to the satisfaction of the Treasury that they are advisable in the national interest.
>
> (2) Issues or participations in issues for undertakings carried on, or to be carried on, in the British Empire Overseas shall only be allowed where it is shown to the satisfaction of the Treasury that urgent necessity and special circumstances exist.
>
> (3) Issues or participations in issues for undertakings carried on, or to be carried on, outside the British Empire shall not be allowed.
>
> (4) The Treasury will not in ordinary cases insist upon the above restrictions where issues are required for the renewal of Treasury bills or other short investments held here and falling due of foreign or colonial Governments or municipal corporations or railways or other undertakings.
>
> All applications should be made in the first instance to the Treasury. The Treasury will not be prepared to approve, under the temporary regulations for the re-opening of the Stock Exchange, any dealings in new issues which have not been approved by the Treasury before they are made.

In the course of a report which he made some short time ago to the United States Government, Deputy-Consul General D. J. Waters drew attention to the fact that, as a result of the war, German chemists have been confronted with a number of very important technical problems. Some of these problems are, he said, old ones that have been rendered acute by the war's interference with commerce, while others are newer, and are all the more difficult because little attention had been given them before the opening of hostilities. The chemists are co-operating in a very marked manner to furnish substitutes for gasoline (petrol) and rubber. "As regards the supply of gasoline, Germany," he went on, "has in the past depended almost entirely upon foreign markets. It has been necessary, therefore, to turn to substitutes, the most important of which are benzol and alcohol. Benzol possesses very valuable qualities as a fuel; but a disadvantage in winter is the high freezing-point. Efforts are being made to overcome this disadvantage by adding nitrogen. There is no danger of freezing if alcohol is added; and mixtures of benzol and alcohol have proved very successful. There is no shortage of

alcohol for motor purposes. Toward the end of August the available supply in Germany amounted to more than 26,000,000 gallons. The problem of providing the industries and agriculture with nitrogen is a serious one. The importation of Chili saltpetre has been interrupted; and the country is short nearly 800,000 tons of this material, as measured by the consumption in 1912. Sulphate of ammonia is the most productive source of nitrogen that Germany has. It is thought that a larger percentage of nitrogen in the form of ammonia can be obtained from coal than has hitherto been done. The synthetic production of ammonia may be of assistance in furnishing a supply of combined nitrogen; and, finally, the manufacture of cyanamide, a mixture of atmospheric nitrogen and calcium carbide, will supply the country with an important nitrogenous fertilizer."

The formation of a powerful Central Committee representing chemical manufacturers and scientific societies has been decided upon, and a meeting of all interested has been convened, and will take place this week at the offices of the Institute of Industry and Commerce, Exhibition Buildings, Aldwych Site, Strand, W.C. Chemical manufacturers can obtain permission to attend the meeting by making application to the Secretary at the address named.

The Acting British Consul-General in Philadelphia (Mr. H. A. Ford) reports that as a result of the cessation of supplies from Germany, an attempt is to be made at Marcus Hook, Delaware County, Pennsylvania, to provide the American textile industry with dyes, and especially aniline oil. The Benzol Products Company, of Philadelphia, which is connected with an important company manufacturing coal-tar products, and said to be supported by a capital exceeding $100,000,000 (about £20,550,000) has purchased 75 acres of land at Marcus Hook, with a view to erecting large modern factories for the production of dyes from coal-tar products. It is stated that 2000 workmen will be employed; and it is estimated that production will commence in about six months' time.

At a conference in Glasgow of the principal gas undertakings in Scotland, it was unanimously decided to approach the Government to ask for the suspension of the Eight Hours Act for Miners, with a view to relieving the present serious delays in the delivery of coal for gas-works. It was stated that 35 per cent. of the Lanarkshire miners are at present serving with the Colours, and that the scarcity of labour and of locomotives is greatly affecting coalowners in the carrying out of their contracts. Bailie T. J. Irwin, of Glasgow, presided over the conference; and the Town Clerk was instructed to communicate the decision arrived at to the directors or committees of the principal Scotch gas undertakings, and request their support in approaching the Government. It was stated that the conference was called on the initiative of the Dundee Gas Commissioners. So far as Glasgow itself is concerned, there is said to be no anxiety as to the supply of coal.

A correspondent of "The Times," in a communication dated last Tuesday, said that Parisians, who have long scoffed at the anti-Zeppelin darkness of London, saw their city that night plunged in even deeper murk. "The police have," he added, "not yet succeeded in persuading owners of private houses and shops to veil their windows; but the grand boulevards were left almost completely without light. Even the lights of the advertisement kiosks were extinguished. Parisians view the extension of the London *régime* to their city with mixed feelings. While they desire to avoid attack by Zeppelins, they also wish to escape death from reckless taxicab drivers, who, despite the darkness, are careering about at the usual speed."

With reference to last week's happenings on the East Coast, the "Daily Telegraph" says: "Many people have wondered what would happen in London, so far as lighting is concerned, in the event of an air raid. The risk is small; but from information gleaned by a representative, it appears that every precaution has been taken by those in authority to meet any emergency. For months past, London has become familiar with a diminished, and a diminishing, illumination of streets and places of business. As is well known, this has been done at the instigation of those in high authority. A visit to the head offices of several of the principal gas and electric lighting authorities elicited the information that the most careful arrangements have been made to deal effectually with the lighting of London in any eventuality. The companies are in possession of detailed instructions as to how they are to act. More than this, it is understood that direct telephonic communication has been established between Whitehall and the chief works. For some time past, the companies have been accustomed to receive instructions almost daily—or, rather, nightly. One night the lighting may be ordered to be diminished in one part of London, and the next night a similar order may affect another part. Therefore, if some such change occurs in any neighbourhood, even to the extent of extinction, there need be no occasion for nervousness or alarm. Everything affecting lighting has been organized with one aim—viz., to safeguard the interests of the citizens, and frustrate the efforts of the enemy."

Immediately after the air raid on King's Lynn last Tuesday evening, the Chief Constable prepared for issue an official notice stating that the electric light in the town would be turned off each evening at 8 p.m., and requesting all shopkeepers and householders to darken their shop-fronts and windows. In the event of a further raid, the townspeople are further warned to put out all lights of any kind, and to extinguish all fires, so as to prevent possible conflagrations.

The question of the further lessening of street lighting and the obscuring of street-lamps has been before the Lighting and Stables Committee of the Birmingham Corporation; and the City Surveyor has been instructed to make a further reduction of lighting in the suburbs by temporarily discontinuing every third lamp, except at street corners and special places. This will obviate the obscuring of about 4000 lamps, and will save gas to the extent of £2500 per annum.

Acting on an order from Brigadier Sir John Ramsay, Commanding the 24th Division, which stipulates that all lights visible from the sea between Brighton and Littlehampton inclusive shall be obscured, the Worthing authorities have suspended the lighting of all the lamps on the Sea Front, which is now in total darkness; and the police are not allowing cyclists to have their lamps alight while proceeding along the front. It is understood that, in consequence of complaints, the Corporation are proposing to whiten the kerbstones in streets which are only dimly illuminated, as a guide to the public, to prevent accidents.

Since the air-craft raid, there has been further restriction of the lighting of Yarmouth; and after six o'clock in the evening, all street lights are now extinguished. Lights in private residences have also to be screened. The question of the lighting of places of worship for evening services has been taken in hand, by the shading of lamps and windows.

The complete list, up-to-date, of employees' contributions to the Bradford Lord Mayor's War Relief Fund includes those of the Corporation Gas Department workers (fifteen contributions), £446 15s. 4d.; of the lamplighters (twenty contributions), £105; and of the Water Department workers (nineteen contributions), £101 6s. 7d. The total contributions to date of Corporation employees have been £5000 14s. 3d.

South Metropolitan Gas Company's Dividend.

The accounts for the half year ended Dec. 31 last show, we are informed by the Secretary (Mr. F. M'Leod) that, subject to audit, the balance to the credit of the net revenue account will enable the Directors to recommend the payment of the statutory dividend at the rate of £5 4s. per cent. per annum, carrying forward to the next account the sum of £1201 16s. 9d.

A New Work Dealing with Legislation.

There is to be published on Thursday of the present week, in accordance with an announcement which will be found in the advertisement columns of this number, a book compiled and noted by Mr. Jacques Abady, Barrister-at-Law, which deals with "Clauses and Precedents in Electricity, Gas, and Water Legislation." Upwards of 450 Acts and Orders have been carefully examined by the author, who has brought together in a convenient form all their provisions as to gas, water, and electricity supply, with respect to the undertakings of both municipal authorities and companies. In thus preparing a guide to the progress of legislation on the subjects named during the last five years, Mr. Abady believes that he is not only providing a useful means of referring to all recent Acts and Orders, but that (in view of the important changes in the conditions of electricity and gas supply which have taken place during the period referred to) the publication will at the same time prove invaluable to those who are proposing, or have it in contemplation, to apply for fresh powers. Pending the fuller notice which will appear in due course, it may be mentioned that the book is being published at the "JOURNAL" offices, at the price of 15s. net.

Sulphate Production at the South Gas-Works, Amsterdam: A Correction.—At the close of the article on "The South Gas-Works, Amsterdam," which appeared in the "JOURNAL" for the 5th inst., some working results were given. We are asked by Mr. Van Rossum du Chattel to point out that the figures for the make of sulphate of ammonia which appear in the lines under the table at the top of the first column of p. 21 refer to 1000 (not 100) kilos. of coal—being equivalent to 11·32 kilos. per English ton.

Prices of Sulphate of Ammonia and Nitrate of Soda.—The average monthly prices of sulphate of ammonia and nitrate of soda during the past fifteen years are shown at a glance on a large chart compiled by Messrs. Bradbury and Hirsch, of Liverpool. Figures are also given showing the production of ammonia calculated into sulphate of ammonia during six years, and the average prices per ton of good grey 24 per cent. sulphate of ammonia, f.o.b. Hull, for the 48 years 1867 to 1914. From the latter table it is seen that the price was as high as £21 per ton in 1872, and as low as £7 18s. 0½d. per ton in 1896.

SEABORNE COAL SUPPLIES FROM THE NORTH.

THE pressing subject of seaborne coal supplies from the North to gas undertakings in the London and southern area has been dealt with in the following correspondence, between the Institution of Gas Engineers and the Admiralty.

The Secretary of the Admiralty, S.W.

Sir,—The attention of the Institution of Gas Engineers has been drawn by gas undertakings in the London and southern area to the serious delay, and, for a period, entire stoppage, of vessels from the North conveying coal to such undertakings.

The result of such stoppage is likely seriously to hinder, and in all probability stop, the supply of gas in the towns affected, to the extreme inconvenience of the public, and the encouragement of disorder.

The Institution would be glad to be assured that the Admiralty will see their way to take such action as will minimize these difficulties, and would be pleased to learn what steps they propose to take in the interests of the community.

Dec. 31, 1914. (Signed) WALTER T. DUNN (Secretary).

The Secretary, Institution of Gas Engineers.

Sir,—With reference to your letter of Dec. 31, I am commanded by my Lords Commissioners of the Admiralty to acquaint you that the question of the maintenance of the supply of coal to which you draw attention is receiving the careful consideration of His Majesty's Government; and arrangements have now been approved by which certain of the enemy ships detained in this country will be used for the transport of coal to meet the pressing wants of the community.

Particulars of these arrangements are being published in the Press; and I am to request that further correspondence on the subject may be addressed to the Secretary of the Over-Sea Prize Disposal Committee at the Colonial Office. The Committee will in future deal with detained ships in this country, as well as those abroad.

(Signed) W. GRAHAM GREENE.

Admiralty, Jan. 16, 1915.

ELECTRICITY SUPPLY MEMORANDA.

THE great fuss that was made in electrical circles over the Ilford preferential charges and fittings trading case, and the appeal that was made by certain busybodies for subscriptions to maintain the action, have ended (as reported in our "Legal Intelligence," and commented upon in our editorial columns) much in the way it was expected it would do by those behind the legal scenes. The subscriptions collected, if any were collected, from foolish local authorities who desired to support contraventions of the law, will now have to be returned; and the Ilford Electrical Engineer, who was once very vexed with the "Electrician" for having prejudged the case in the light of the decision on the Long Eaton matter, has no doubt already revised the view he then entertained, that in one part the Ilford position was not governed by the Long Eaton judgments. His opinion did not coincide with that of one of the learned Counsel who appeared in Court when the Ilford case was mentioned in December; and manifestly it did not agree with that of the legal advisers of the District Council—seeing that, after mature consideration, they advised that the Council were acting contrary to the law. Then there is the second point as to the trading in, and hiring-out of, electrical fittings. The Council have accepted the view of the Gas Company in this particular also, and have with the New Year made the good resolution to be good in future, and not to again transgress. In other words, there is an admission of having acted *ultra vires* on all counts; and, this being so, the Council have got to pay the costs of the proceedings up to the settlement. There is not the slightest doubt that, when the case was mentioned in Court last month, Counsel for the District Council then felt the weakness of their position, and felt it more when before Mr. Justice Sargant last Wednesday, for their surrender on this occasion was complete. How particularly foolish must the men now feel who have circularized local authorities, asking them to be charitable, and provide funds for the support of the District Council? There is no doubt that a further resolve exists on the part of the Council, and that is to, as early as possible, go to Parliament, not to get the right to make preferential charges, but to obtain the power to prosecute business in electrical fittings. When they do this, the Electrical Contractors' Association may be relied upon to see that the Council do not cross the recognized legitimate line in the matter of authorization. Parliament has now standard clauses which apply (with the necessary conversion of certain terms) to both gas and electrical fitting trading by local authorities; and, when the time comes, the Ilford District Council will have to accept the terms Parliament chooses to impose, and not the "flexible" ones that the Council would indubitably prefer.

The Ilford Sequel.

That Old Municipal "Shop" Argument.

A writer in the "Ilford Guardian" referring to the case, does not commit himself on the righteousness or otherwise of municipal trading, but advances some curiously loose arguments on the subject of the patronage of the ratepayers' own shop—taking the municipal tramways as illustration as opposed to the convenient motor bus provided by private enterprise. The ratepayer's proprietorship in this particular "shop" appears to be a rather one-sided affair. If there are losses, he has to pay—that is the privilege of his proprietorship; and in order that the reluctant ratepayer proprietor should lighten the compulsorily imposed contribution to losses if they are made, he should always avoid the buses, and, though he may sacrifice time, hang about for a tram, so as to swell the revenue of the municipal "shop." The argument is a pretty one; and it has been so hard-worked that it is now much worn. We are almost sorry for the dejected appearance that it presents on account of its large rejection by people of common sense, and people who decline, as far as possible, to be the slaves of the fetish of municipal trading. If statutorily controlled private enterprise ran the trams, the people would be as well served as they are by the District Council; and private enterprise would have to stand any loss resulting from the trading, and not the ratepayers. The "Ilford Guardian" counsellor would also have his argument applied to electricity supply. Apparently, according to his view, the electricity supply, being in the hands of the Council, should be patronized in preference to the gas supply in the hands of the statutorily controlled Company. We fail, in the first place, to see why the freedom of choice by the individual should be subordinated in any way to municipal trading. Why should the individual go from the commodity which gives him best value for money, in regard to light, heat, and power, to another, which gives him less value, because municipally controlled. The eye-injuring intrinsic brilliancy of metallic filament electric lamps, their wider departure than incandescent gas-lamps from the spectrum of the sun, and the lower heating capacity of the electric radiator compared with the modern gas-fire, are to be accepted by the ratepayer, because of the municipal ownership of the electricity undertaking. The ratepayer is to get lower quality and pay more for it, and simultaneously probably have the pleasure of harming one of his largest fellow ratepayers in the district. If the ratepayers, by any such foolish action, depreciated so much the trading position of the Gas Company, it would mean that the economical and valuable primary commodity that the Company sell would have to be charged for at higher prices, to the disadvantage particularly of the poorest users.

Contractors Active.

Electrical contractors are showing their teeth. At Doncaster and Edinburgh, they have been making moves in resisting the proposals for parliamentary powers which threaten what they regard as their interests as private traders. So successful have they been at Edinburgh, that the Town Council have decided to delete the objectionable fittings, trading, and hiring clauses from their Provisional Order. At Sheffield, the dispute as to what is embraced in the actual powers possessed by the Corporation have advanced another step. There was a Local Government Board inquiry the other day into an application by the Corporation for authorization to utilize a certain site for the erection of offices, and the construction of shops underneath. The Inspector was faced by Counsel on behalf of the electrical contractors, whose contention was that the contemplated and so-called shops were only a blind for show-rooms for electrical trading purposes; and the alleged illegality of the Corporation running show-rooms was submitted. The question of illegality, however, was not one for the Inspector. It is a matter for the Law Courts. The Corporation contend that they have a right to run electrical show-rooms, and so have no occasion to ask the Local Government Board for power in this respect. The contractors, on the other hand, maintain that the Corporation have not the power, and that the new show-rooms are intended to enable them to go in for the sale of electrical appliances. It does not appear to us that, beyond showing that they are alive, and indicating their continued vitality, the contractors have done much, by their appearance at this inquiry, to improve their case at Sheffield. The more effective time for opposition will be when the Board, on the application for a loan, go into the details of the scheme. Meanwhile, there has been some correspondence between Mr. W. R. Rawlings, on behalf of the Electrical Contractors' Association, and Mr. Alex. C. Cramb, of Croydon, on behalf of the Municipal Electrical Association, to see whether there is any possibility of a compromise on the Association Bill for fittings and other powers, which Bill is still lying dormant, as it has been more or less for years. But the Association are riding high and mighty over the matter; and they have slammed the door, by their uncompromising attitude, on all hopes of a peaceful settlement.

Bombs from Above.

The question of safety in time of war in connection with the concentration of electricity generation plant has again cropped up with the advent of the London County Council unifying scheme. The same question has been raised each time

the subject of electrical consolidation in the Metropolis has been brought forward. With the great and terrific European war in full swing, and with the new knowledge of what can be done in the nature of air raids and bomb dropping, the point which has been the subject of ridicule in the "piping times of peace" has about it larger importance. From the military point of view, a large concentration of the plant upon which London depends for any one of its public services would be a mistake. The Electricity Committee of the Poplar Borough Council, in a report in which strong objection is raised to the County Council scheme, make a point of the vulnerability of a single generating station in time of war, and find argument in the greater security against breakdowns or labour troubles of a multiplicity of stations than of one station. Whatever weight or otherwise there may be in the criticism, Mr. G. H. Hame, the Chairman of the Special Electricity Committee of the London County Council, has not done much to dispose of it, by pointing out that Poplar is under a misapprehension by one station. While the Council are not proposing to close-down all the existing stations at once, their objective is the gradual establishment of two large generating stations—one on either side of the Thames—from which supplies would be given in bulk to the several existing distributors, who (presuming that the scheme is ratified by Parliament) do not at once fall into the absorbing and unifying scheme. Two stations, instead of one, do not very hugely affect the argument. The Germans lately showed their appreciation of the inconvenience to communities of depriving them of the sources of light, heat, and power by disabling the Hartlepool Gas-Works, and peppering with shells the ground in the direction in which they knew the Scarborough and Whitby Gas-Works were located. The fewer the sources of supply, the less the trouble to which the enemy would be put with air-craft and bombs. The new methods of warfare are factors that have to be taken into account in deliberating over the question of the security of public supplies, although it will be argued that, this fearful war over, even the most bellicose nation will have had enough fighting to last it for a generation or two, and that economy in the meantime must be considered. But the war shows that economy and security must be considered in their relation the one to the other. This country would have been in a different position at the commencement of the war in regard to the army if security had had equal place with economy in national policy. There would not have been the necessity for a mad rush for more and still more men after war was declared, if a Roberts or a Kitchener had only had his way in good time.

Contradictory Wiring Rules and Practices.

One prevalent fault in the electrical industry is that its technical men cannot in anything settle down to a general mode of procedure, governed by special circumstance. This is seen everywhere. Witness is found in London in policy, in generating plant equipment, in distribution systems, in the means of utilizing energy for lighting, heating, cooking, and power, and even in the charges to consumers—some get undue preference; some pay extravagantly more for less service. The same muddle exists in connection with interior wiring systems. Unless one is an expert, one does not know—until later on—whether or not one is getting value for money. This has been found in Government buildings and mansions; and it has been found in the middle-class jerry-built houses in Suburbia. Wiring rules are issued by the Institution of Electrical Engineers; and, generally speaking, they are more honoured in their breach than in their observance. The wiring rules favour the use of the conduit system of wiring, and the employment of wood casing only on the surface. But Messrs. J. C. Banister and C. R. Bates come along; and, in a paper before the Association of Supervising Engineers, hold that in conduit wiring faults are more prevalent than in casing work. With casing and good work, they contend, faults are practically unknown; and the life of the wires is longer, owing to the absence of condensation. We are reminded of the litigation between the War Office and certain Consulting Electrical Engineers, on learning that the authors of the paper suggest that, in place of the conduit system where any part of the wiring has to be buried, one of the metal-covered wire systems should be adopted. At points where the casing passes through floors, it is suggested, sheet lead or zinc should be dressed round the casing to protect it from being wetted during floor washing. A wonderful amount of care has to be taken of electric wiring; for it is highly susceptible to the causes of trouble, and this, with the hundred-and-one protective devices demanded by it to promote as far as possible good service, makes it a far more expensive tenant of a house than the plain iron barrelling required for the conveyance of gas.

Scrapping Cooking Appliances.

Some time since it was stated in the "Memoranda" that the Brompton and Kensington Accessories Company found it necessary thus early to scrap the cooking equipment fitted up in their comparatively new restaurant in the Earl's Court Road. It seemed rather soon to be scrapping electrical apparatus so recently fitted up; and at the time we confessed to a little curiosity as to the real causes of, or motives for, making the change. There has been the usual electrical hesitancy in making a clean breast of the matter. The "Electrical Times" now describes the new apparatus with which the restaurant is equipped; and naturally our contemporary feels that it must say something as to the reasons for having recourse to the scrap-heap in these early days in the career of the restaurant. But it is cautious, and says as little as it possibly can on the subject. Two reasons are assigned for making the change. One is that the original outfit had a capacity greatly in excess of the requirements of the restaurant, and the other is that the electrical equipment proved unsatisfactory when subjected to the severe conditions of busy restaurant practice. These confessions point to two things—First, that the originators of the restaurant entertained at one time absurd notions as to the amount of patronage the restaurant would receive, and so made over-provision of electrical apparatus; and, second, that their electrical judgment was much at fault as to a satisfactory equipment when planning the place. The congratulation and jubilation and high talk that took place in the electrical papers at the time the restaurant was opened as to the splendid character of the installation stand on the printed records as testimony, in face of the charge that has lately been made about the technical incompetence of those who wrote so much at large. The Brompton and Kensington Accessories Company have (as was stated in the course of the previous reference to the matter) now devised cooking apparatus of their own. It has been designed in order to give, among other virtues, facility for the examination and replacement of the heating units, to render the parts fool-proof, as well as to obtain trustworthiness. These features no doubt indicate where the predecessors failed. We are told that there are now in the restaurant two "large" ovens, with a hot cupboard between. But when we see that the ovens only measure 20 in. by 15 in. by 14 in., we are dubious as to the correctness of the application of the term "large." These ovens are each fitted with four 500-watt heating elements. Then—probably through the Company having had experience of the dreadful lag there is in the heating-up of certain electric-ovens, and of the loss of heat that takes place from them—the ovens have been lined with blue planished steel, have been given double casings, and have been heavily lagged all round. These are electric-ovens—not warships. If heat can be kept prisoner in an electric-oven, this construction ought surely to do it. The boiling rings vary in size from 6 to 10 inches, and are loaded from 800 to 1500 watts at full heat, each disc having three-heat control. We cannot go into a description of the rest of the apparatus; but the story of the quick scrapping of the first equipment of the Brompton and Kensington restaurant, and its replacing, will serve as a warning to other restaurateurs to exercise caution if tempted to turn from trustworthy and economical appliances to electrical operation.

THE CANDLE POWER OF SEARCHLIGHTS.

Last Tuesday a discussion took place, at the meeting of the Illuminating Engineering Society, on the scientific development and practical applications of search-lights. It was introduced by Mr. P. G. Ledger, who made the following observations on the candle power of the lights under consideration.

The candle power given by a strong searchlight is very troublesome to measure. The mere fact that the volume of light is so large gives rise to difficulty; and even the best arc lamps are necessarily less steady than, for instance, the ordinary glow lamp. Fluctuations in the intensity of the light and the colour take place as the carbons are consumed. Tests may be carried out at a distance of 1000 yards or more; the light being merely balanced against a suitable standard on a photometric bench in the usual way. While this may give some indication of the illumination to be derived from a searchlight, in practice the variable absorption of the atmosphere introduces considerable difficulties. Experiments have, however, been made in very clear atmospheres, and these show the power varies from about 4 million candles with a projector 16 inches in diameter and with electrodes using acurrent of 20 amperes, to as much as 180 million candles with a 60-inch projector and a current of 150 amperes.

It may be remarked, however, that, apart from the difficulties of measurement, the candle power of a searchlight is not theoretically such an indefinite quantity as people sometimes suppose. The total flux of light is clearly a definite physical quantity, and it is only in the case of an absolutely parallel beam (with which one would get the same illumination, except for atmospheric absorption, independent of the distance) that the value to be assigned to the candle power becomes doubtful. But in practice such a beam is never attained; and even with a divergence so small as 2° to 3° the true centre of the beam can be located at a certain readily calculable distance behind the arc, so that the results at distances of 1000 and 2000 yards do not deviate widely from the inverse square law. Naturally, allowance must be made for the true position of the centre of radiation.

The apparently enormous intensities of searchlights are merely a consequence of the light being concentrated in a very restricted angle, far less than would ever be met with in the case of sources used for artificial illumination, even when equipped with a so-called "focussing" reflector. According to data given by Nerz, it would appear that a 150-ampere lamp, operating at about 9000 watts, gives a mean horizontal intensity of about 46,000 candles in the direction of the mirror. The intensification factor of a 150 centimetre mirror would be about 4300. However, for the reasons given above, the candle power is a very uncertain quantity in practice, and is not, as a rule, specified.

THE INCEPTION AND DEVELOPMENT OF THE BRAYSHAW GAS-FURNACE BUSINESS.

A Business Development Promising a Further Large Expansion.

On all hands, and day by day, we see the place of gas in industry becoming through experience more clearly delineated and assured. And the most perceptive among us who are brought into contact with the utilization of the gaseous method of heating in industrial operations, and know of the accompanying benefits, have absolute confidence that there is here a large field of indefinable area for both the gas industry and for those who specialize in the making of the apparatus suitable for industrial needs. We look for immense developments in this direction; and there are many signs that we shall not look in vain—among them being the patent fact that knowledge is circulating with increasing speed among the manufacturers of the country that for them heating by gas has advantages in excess of those summed up by the two words "fuel costs."

A Potent New Concern.

Among the firms who have specialized in the designing and production of gas-furnaces and other heating apparatus for industrial purposes—furnaces of large and small capacity, furnaces for extensive and small operations, and furnaces for a great variety of uses—are Messrs. John Wright and Co. This branch of their business has grown on a very liberal scale; and the evidence that has accrued to the firm from this points unerringly to their experience in this regard being only the index to much greater developments. One need not say anything as to the resources possessed by the firm for producing, exploiting, and cultivating the application of gas to industrial operations, and for attacking every and any industrial heating problem that may arise. But to these resources there have been added others, through a fresh move of which announcement was recently made, and which it may be calculated will not only have good effect from the commercial point of view for those directly concerned, but will have excellent results generally for the gas industry. In short, what Messrs. John Wright and Co. have done has been—recognizing the commercial position and prestige, as well as the technical ability and wide experience, of Mr. Shipley N. Brayshaw and Mr. E. Russell Brayshaw, of Manchester—to take the step which has brought these gentlemen into closer association with the gas industry, and broadened both their opportunities and those of the industrial heating branch of the Birmingham firm. In other words, Messrs. Brayshaw's business has been converted into a Limited Company, under the style of "Brayshaw Furnaces and Tools, Limited;" and in this Messrs. John Wright and Co. have become intimately interested and associated. Incidentally, it may be mentioned that the two works where Messrs. Brayshaw have been carrying on their business are situated at Mulberry Street, Hulme, and at Vernon Street, Longsight—both in the Manchester district, and therefore in the centre of vast industrial operations.

Necessity the Mother of Invention.

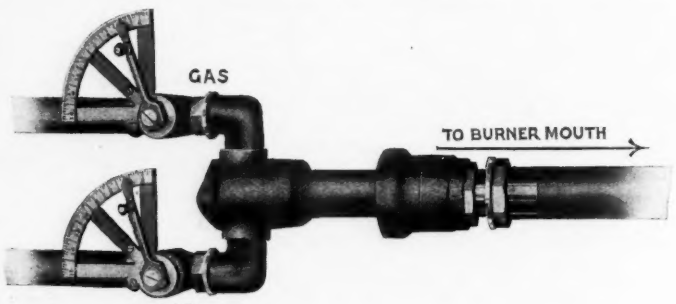
It is interesting to be brought into touch with the beginnings of a business which, solely through the realized efficiency of apparatus, has made a reputation such as that enjoyed by the Brayshaw industrial gas burners and furnaces, and which has given to the brothers a personal, practical experience in a wide variety of work in this particular line which may be said to be peculiar. The business has been built-up entirely from personal research work, and upon the original designing of furnaces adapted to the special requirements of any case. To begin with, Messrs. Brayshaw were not gas-furnace makers; their original business being that of makers of cutters and tools. It was because in the carrying on of the business they found it impossible to get any furnace maker, either here or in America, to realize the essential functions that the different types of furnaces had to perform in dealing with the hardening of the steel and tools with which their business was concerned, that they found themselves compelled to design and construct furnaces for their own special needs.

These circumstances obviously made for a degree of close adaptation of apparatus to requirement such as could not be expected where makers are without any inside practical knowledge of the working of the processes for which their apparatus is intended. Of course a knowledge—no matter how intimate—of the needs of a case is not in itself necessarily an absolute qualification for designing apparatus to adequately meet the need. But in this instance Messrs. Brayshaw were equipped with a thorough technical and scientific training before starting business—being chemists as well as engineers, and both of them Members of the Institute of Mechanical Engineers and of the Iron and Steel Institute. In this connection, we recall an interesting paper read before the Institution of Mechanical Engineers by Mr. Shipley N. Brayshaw in 1910, entitled "A Research into the Hardening of Carbon and Low-Tungsten Tool Steels." This paper was in the nature of a masterpiece; it, with the report of the discussion which it evoked, occupying an entire volume of the proceedings of the Institution, and running to fully 700 pages. Two evenings had to be devoted to its consideration; and in the discussion such authorities as Professor J. O. Arnold, Professor Carpenter, Dr. Rosenhain, and others took part.

The Hall-Mark of the Mint.

From the small beginnings incident to the designing of apparatus for their own individual wants, the Brayshaw furnace business has grown to be by far the largest—that is to say, largest purely gas-furnace business—in this country. To trace the course of development would take up too much space and time. But there is at once the highest attainable evidence of success, and a clear explanation of it, in the fact that Messrs. Brayshaw are the makers who have succeeded in giving satisfaction in the melting by gas of the bullion at the Royal Mint—which, of course, includes the melting of large quantities of nickel-bronze.

Interesting allusions to the work of Mr. Shipley Brayshaw in facilitating work in this Department of the Royal Mint, and in rendering possible substantial advances and economies in the melting-houses of the national establishment, are afforded in the successive annual reports of the Deputy-Master and Comptroller, beginning with the report of 1910, and continuing in those of 1911, 1912, and 1913. The first of these reports indicates that it was the gas-burners designed by Mr. Shipley Brayshaw which rendered it possible for the Royal Mint to discard the fuel they had hitherto employed, and to adopt gas, with substantial reductions in the cost of fuel, as well as an equally marked increase in the life of the crucibles and of the furnace-linings. These results were the more remarkable because they coincided with a material enlargement of demand upon the resources of the Mint, such as caused the output to form a quantitative record among the annual meltings.



Brayshaw's Patent Furnace Burner.

It is interesting to glance back through these reports from the Royal Mint, where developments are taking place which, it is expected, will make the name of Brayshaw, so to speak, a "household" one not only in the gas industry but in the industries generally. In the 1910 report, the Deputy-Master and Comptroller, referring to the adoption of gas, states:

> The results have been very satisfactory, especially in gold melting, where the cost of fuel for working standard gold bullion has been reduced from 7d. to 5d. per cwt., and the crucibles are found to stand, on an average, 50 per cent. more heats, while the endurance of the furnace linings is also satisfactory.

In the appendix to the same report, the Superintendent of the Operative Department remarks:

> The adoption of gas as a fuel in place of coke has been accompanied by several incidental economies; and it is interesting to note that the present charge for fuel averages about 4¼d. per cwt. of standard gold bullion, as against 7d. when coke was used. It should be added that in this statement the fuel needed to warm-up the furnace in the morning has been eliminated; but including this the cost rarely exceeds 5d. per cwt. on a day's work.

The Superintendent goes on to recount how experiments on the use of gas and oil in melting have been in progress since early in 1909. During this time, many different types of furnaces were tried; some being specially designed for the purpose. In this connection, it is interesting to note the following remark of the Superintendent:

> Electric furnaces were also experimented with; but even had the cost of working such a plant as could have met the demands of the Mint not been prohibitive, this type of furnace does not lend itself to the melting of precious metals where the entire charge must be recovered daily for accounting purposes; and it is not possible to effectively stir the alloy—so essential in the case of bullion for coinage.

Oil furnaces for petroleum and creosote were likewise tried; but while these were more economical than coke, there were other

grave objections. In connection with the experiments, not only did the Superintendent pay a number of visits to factories in London and the provinces where oil or gas were used as fuel for melting purposes, but he also journeyed to the United States and Canada, in order to collect useful data. As already indicated, the final result was that, in the words of the Superintendent:

> The burner ultimately adopted was made by Mr. S. N. Brayshaw, of Manchester, after a series of experiments which we conducted with several tentative forms of burners.

Mr. Brayshaw's success in this matter has been not only a triumph as regards his own reputation, but has been the means of scoring a notable success on behalf of the use of gas as a fuel. In this connection, a further sentence may be quoted from the Superintendent's 1910 report:

> The marked reduction in the weight of gold sweep is attributable to the use of gas as fuel, owing to the fact that no fuel residues require to be dealt with, as when coke is used.

As a result of the success of the Brayshaw gas-furnaces for the melting of gold, sixteen furnaces of the same make were installed in the silver-melting house. The report for 1911 states that these proved "highly efficient;" and this, notwithstanding the fact that the output for 1911 exceeded that of any previous year. Referring in the report for this year to the Brayshaw furnaces installed in the silver-melting house, the Superintendent observes:

> As evidence of the efficiency of the melting plant in comparison with that in the old house, it may be mentioned that, on Oct. 3 last, silver only was melted (bronze being temporarily put on one side), and that in an ordinary working day no less than 314,304 ounces—or 9·6 tons—of metal were cast into coinage bars. A corresponding day's work in the old house would only have produced about 5 tons of bars.

In the report for 1912, the Master and Comptroller states that:

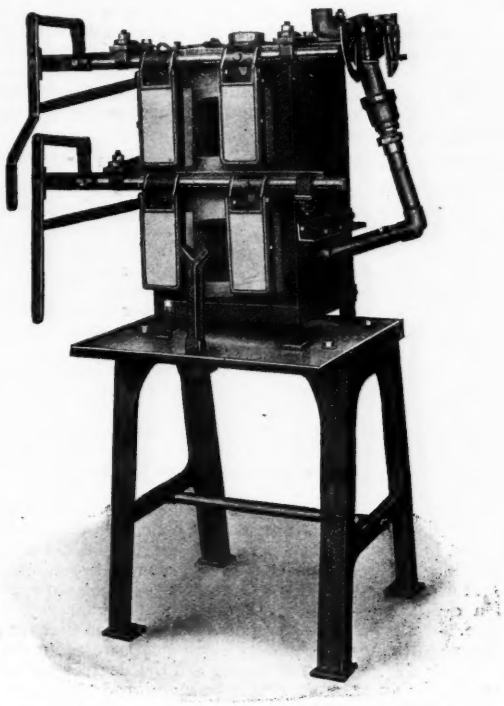
> A further reduction is noted in the cost of melting due to the greater efficiency of the new gas-melting furnaces.

Amplifying this, the Superintendent remarks:

> A further improvement is observable in the efficiency of the new gas-melting furnaces. Whereas in the nine months of 1911 during which they were in use, the average cost of fuel was 13·8d. per cwt. of metal melted, in 1912 there were 1498·2 tons melted at a total cost of £1290 for gas, corresponding to an average charge of 10·3d. per cwt.

The report for 1913 indicates that "123·8 tons of nickel-bronze bars were required; none of this composition having been melted in the preceding year." The Superintendent proceeds to say: "It is desirable that I should here record the fact that this is the first occasion on which nickel-bronze bars have been called for since coal gas was adopted as the sole fuel on Jan. 24, 1911." Succeeding is a comparative statement of cost, using coke and using gas, from which it is interesting to find that in fuel, in crucibles, and in wages alike, considerable economies were effected; the total reduction in the rate per ton for fuel, crucibles, and wages combined being from 82·06s. with coke, to 59·62s. with gas used in the Brayshaw burners. The Superintendent further records:

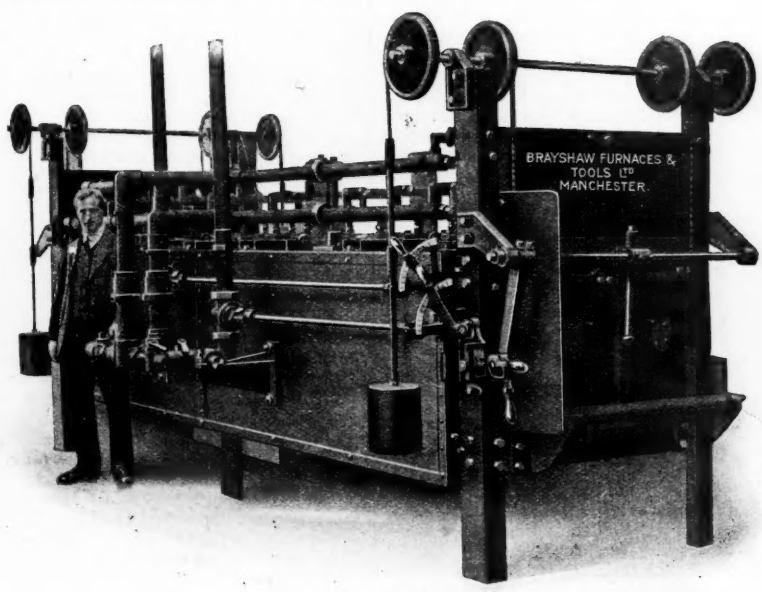
> The gross saving per ton of good bars is seen to be no less than 22·44s., or 27·3 per cent. of the total charge in 1909. Side by side with this economy, there has been a very marked increase in efficiency, both in regard to the output per furnace and per man, as well as many minor economies. . . . The output per furnace per day has risen.



Brayshaw's Gas-Heated Twin-Chambered Furnace.

The Patent Gas and Air Mixer.

So much for the history of the successful development—successful as proved by working results—of the Brayshaw industrial burners and furnaces. An interesting development of the Brayshaw burner is found in the Brayshaw patent mixer for gas and air, which is a contrivance that has obtained entirely novel results in the burning of gas. At the advent of the invention, the German Patent Office challenged it; but a patent was eventually granted by the Office, on a certificate being given by the National Physical Laboratory at Teddington, which incidentally furnished very gratifying and quite unique figures to the credit of the Brayshaw apparatus.



Brayshaw's Gas-Heated Blast-Furnace.

The patent mixer is an essential part of the Brayshaw burners used at the Mint for melting purposes. Naturally, too, Messrs. Brayshaw have applied it to their own hardening, annealing, forging furnaces, &c.; and their experience has confirmed the results of the investigations of the Royal Mint officials—viz., that the appliance effects an economy in gas consumption of a material commercial order.

In addition to the economies effected by the mixer, a further result of signal value is found in the fact that, when applied to furnaces specially designed for the purpose, these yield extremely high temperatures—temperatures such as, we are informed, have

hitherto been unattainable with gas. As the mixer lends itself to use in furnaces of great length, it has rendered gas-fired furnaces capable of competing, on equal terms, as commercial rivals of coal and coke fired furnaces. Similarly the mixer enables higher temperatures to be reached with furnaces employing producer gas; and apparatus of this kind is consequently an important speciality in the business.

The Salt Bath Method of Annealing and Hardening.

Another branch of Messrs. Brayshaw's original work in connection with gas-furnaces—and one which is of peculiar interest, both because of its own great utility and because it represents entirely new ground which they have broken for themselves, and which they still occupy entirely alone—is their salt bath processes for the annealing, hardening, &c., of various steels. Their salt bath methods were primarily evolved by them for the purpose of obtaining absolute uniformity in heating—a result which is quite impossible in an open muffle or oven furnace.

In connection with the hardening of steel tools, there are three essentials. The tools must be (1) hard, (2) durable, and (3) uniform in hardness and durability. What Messrs. Brayshaw set themselves to accomplish was to make the hardening operation one of mechanical regularity as much as any other part of the work of producing the tools, and so avoid the common element of uncertainty.

The hardening operation consists of heat treatment; and accurate and uniform heat treatment is becoming more and more essential, in order to keep pace with the increased efficiency of production in other respects. The hardening processes in very general use are practically the same as those which were employed half a century ago; and in them the heat is simply judged by the eye. It has not yet been generally recognized that very small variations in the temperature to which steel is raised make differences quite disproportionately large in the degrees of hardness attained. As an example, it may be mentioned that, in one case in mind, a difference of 1° C. makes a difference of no less than 50 per cent. in the life of the tool. Realizing these facts from their own personal knowledge and experience, Messrs. Brayshaw, by employing their salt baths in the hardening processes, introduced an element of exact control in regard both to time and temperature, and so placed the process itself upon an absolutely mechanical basis. Thus the process has become "a tool job" as much as the use of a lathe or a milling machine, and equally subject to precision of measurement.

In this way the Brayshaw cutters are all hardened by a heat treatment which, being absolutely under control, ensures the maximum uniformity of hardness, toughness, and durability. What they have been able to do in this way for the tools of their own manufacture, they have enabled numerous other tool manufacturers to do by the use of their salt bath methods. The pieces to be hardened are immersed in the liquid medium in the bath (the liquid medium consisting of a red-hot molten salt), with a pyrometer; and so everything is at one uniform temperature. In this way, a hundred pieces can be immersed one after the other, with absolutely uniform conditions, and consequently results.

This heating of tool steel in fusible salt led the inventors to extend their experiments to the quenching—also in a suitable fusible salt—of high-speed and carbon steels, in which direction their methods have now been largely adopted. Different compositions have been made for the various purposes; and in this Messrs. Brayshaw's knowledge as chemists has naturally had a very important bearing. Among these various baths, or "melts" as they are technically called, are a "Barium Chloride Melt" for heating high-speed steel; "Pyromelt" for heating carbon steel and carburized work; "Feusalt" for quenching high-speed steel and for tempering any steel above 250° C. (482° Fahr.); and patent "Quenchite" for quenching carbon steel, and for tempering any steel above 150° C. (302° Fahr.).

Prospective Developments and Current Demand.

So far from regarding their present state of progress as final, Messrs. Brayshaw have, we learn, some new processes and new apparatus in reserve, which the greatly increased resources now at the disposal of the combined concern will enable them to develop on a suitable scale. They have already established the nucleus of an excellent foreign trade; and as there are not in any foreign country equivalent processes to those here described, they have every reason to anticipate that their business abroad will, at no distant date, assume very large proportions.

As regards home trade, our anticipations as to the future receive support from the fact that both the works of Brayshaw Furnaces and Tools, Limited, at Manchester, and also the associated gas-furnace works at Birmingham, are at present working at high pressure in order to cope with the constant inflow of orders for gas-furnace apparatus for a great variety of purposes—largely connected, directly or indirectly, with Government work arising out of the war.

The accompanying illustrations show Brayshaw's patent burner and two of the more important among the extensive range of Brayshaw gas-furnace apparatus.

Society of British Gas Industries.—The annual meeting will be held at the Trocadero Restaurant, Piccadilly Circus, W., on Thursday, March 18, and the annual dinner will take place the same evening.

WATER LEGISLATION FOR 1915.

In preceding issues of the "Journal" the principal features of the Gas Bills and Provisional Orders for the present session have been indicated. We now deal with the measures relating to water supply; taking first those promoted by companies.

Further powers are required by the Frimley and Farnborough District Water Company. Under their Act of 1909, the quantity of water to be pumped from the well at Odiham was limited. The Company are now applying for the repeal of this restriction. Authority is also required for any urban or rural district council whose district is wholly or in part within the Company's limits to guarantee payment to them of the cost of laying down any pipes for the supply of water in the district. Water for motor washing or stable purposes is to be supplied by meter, so long as it does not interfere with the domestic supply. Authority is sought to raise additional capital to the amount of £40,000, inclusive of premium; and it will carry 7 or 5 per cent. according as it is issued as ordinary or preference capital. Power to borrow to the extent of one-fourth of the new capital, and to issue debenture stock, is sought. The Directors wish to be authorised to appoint a Managing-Director and determine the Secretary's remuneration. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Southend Water Company require power to raise additional capital to an amount not exceeding £250,000 by the issue of new shares or stock, and to create and issue debenture stock. Authority is sought to borrow to the extent of one-third of the new capital raised at the time of borrowing. The Company propose to construct seven pumping-stations, to be situated in the parishes of Hockley, South Fambridge, Canewdon, Paglesham, and Canvey Island, and a tunnel in the parish of Fobbing; and they require fifteen years for their completion. It is specified that a supply of water for domestic purposes is not to include any used for washing horses, carriages, or motor vehicles if a hose-pipe is employed; but the Company are willing to afford such a supply by meter. As in the Frimley and Farnborough case, authority is required for any urban or rural district council whose district is wholly or in part within the Company's limits to guarantee payment to them of the cost of laying down pipes to supply water in the district. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

Authority is required by the South Staffordshire Water-Works Company to extend their limits of supply so as to include a number of parishes in the rural district of Cannock, in the county of Stafford; also to construct new works, consisting of two wells and pumping-stations in the parish of Brewood, and two pipe-lines in connection therewith. Seven years are required for their completion. Additional capital to the amount of £150,000 is applied for, the dividend on which is to be 7 or 5 per cent. per annum according as it is raised as ordinary or preference. Power is sought to borrow to the extent of one-third of the new capital, and to create debenture stock. In the case of water supplied for domestic purposes being used in stables by means of a hose-pipe, the Company seek authority to charge any additional sum not exceeding 20s. per annum. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Sutton District Water Company seek authority to construct additional works, consisting of a well or wells and pumping-station in the parish of Cheam, in the rural district of Epsom, and a conduit or pipe-line connecting it with a service reservoir to be built in the same parish. Six years are required for completing the works. Capital is applied for to the amount of £250,000, including premium, with the usual power to borrow to the extent of one-third. [*Parliamentary Agent: Mr. J. Kennedy.*]

The Bill of the Weardale and Consett Water Company is to empower them to construct additional works of an extensive character. It is proposed to revive the powers conferred by the Weardale Act of 1902 to make and maintain the Barnhope reservoir, an aqueduct terminating therein, a tramroad, and a road diversion, all in the parish of Stanhope, in the rural district of Weardale, in the county of Durham. Additional powers are required for the construction of three intakes and weirs, a pumping-station, eight pipe-lines, a break-pressure tank, and a service-tank; and confirmation is sought for the construction of the existing Wheatley and Wilks Hill reservoirs. For the completion of certain of the new works specified, the Company require fifteen years, and with regard to the other works five years, from the passing of the Bill. The existing capital is to be applied to the purposes of the intended Act. The rates for water supplied for domestic purposes are to be 13s. per annum where the rateable value of the premises does not exceed £6 10s.; and 10 per cent. on such value where it is above this figure. Water may be supplied by measure for domestic or other purposes, at a price not exceeding 2s. per 1000 gallons. The general provisions of the Bill give power to the Directors to determine the remuneration of the Secretary, make superannuation and other allowances, erect dwelling-houses for persons in the Company's employ, purchase water, and supply it in bulk beyond the limits. [*Parliamentary Agents: Messrs. Torr, Durnford, and Co.*]

The West Gloucestershire Water Company are applying for the amendment of the borrowing powers they possess under their Acts, and for authority to raise on mortgage or by the issue of debenture stock such sums as, with the aggregate amount raised at the date of the passing of the Bill, will make £86,666 in all. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

Powers in regard to the supply of water are required by the following local authorities.

The Ammanford Urban District Council apply for authority to lay pipes in private streets, repair communication pipes, maintain pipes used for the supply of water to several houses, or parts thereof, in the occupation of different persons, and fix and maintain appliances for the prevention and detection of waste. Where water is used in stables by means of a hose-pipe, the Council wish to be authorized to charge not exceeding 20s. additional per annum for it. [*Parliamentary Agents: Messrs. Bircham and Co.*]

Additional powers in regard to their water undertaking are sought by the Ashington Urban District Council. They propose to construct a service reservoir in the parish of Cockle Park, four aqueducts in the parish of Newtown, and two others in the parish of Tosson, all in the county of Northumberland; and they ask for seven years within which to complete them. Authority is desired to make bye-laws for preventing the pollution of the water. The Council ask for permission to borrow £73,000 for the purchase of lands and easements for, and the construction of, the above-named works, and £8000 for new mains, service-pipes &c.; the former amount to be repaid within sixty, and the latter within thirty, years from the date of borrowing. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Barnoldswick Urban District Council are applying for power to construct new works, comprising an impounding reservoir in the parish of Elslack, a service reservoir, two aqueducts or pipe-lines, a catch-water conduit, and a road diversion, all in the West Riding of the county of York; and they require ten years for their completion. Until the impounding reservoir is finished, the Council wish to be authorized to take water from the Elslack Beck; but afterwards they will discharge during each working day of 24 hours not less than 127,000 gallons of water into the beck, and not less than 10,000 gallons into the Acre Gill Beck, in a continuous flow. The Council wish to be authorized to make bye-laws for the prevention of the pollution of the water. Borrowing powers are required to the amount of £99,155 for the purchase of lands and the construction of works, and £3000 for new mains, service-pipes, &c.; the former sum to be repaid within sixty, and the latter within thirty, years from the date of borrowing. [*Parliamentary Agents: Messrs. Lees and Co.*]

A short Bill has been promoted by the Bury and District Joint Water Board to obtain an extension of time for the completion of works authorized by their Act of 1903. By section 19 of the Act a certain period was specified for carrying out the New Hall and Scout Moor reservoirs. This, however, was extended by the Board's Act of 1908; and a further extension is now required to ten years from Aug. 14, 1920. By section 3 of the Act of 1908 the time specified in section 22 of the earlier Act for the compulsory purchase of lands was extended; and the Board now wish for a further extension to seven years from Aug. 14, 1915. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

As already mentioned in the "JOURNAL," the Doncaster Corporation have included in a General Purposes Bill certain provisions in regard to their gas undertaking, and these have been duly noticed [*ante*, p. 74]. There are also others relating to the water undertaking. The Corporation require power to construct a service reservoir in the parish of Warmsworth, in the rural district of Doncaster; and they ask for seven years for its completion. Miscellaneous provisions relate to the supply of water for motors, the repair of meters by consumers, the sale of meters and fittings, the hire of fittings, and the supply of water in bulk outside the limits. Authority is sought to borrow £16,000 for the construction of the reservoir, and sixty years from the date of borrowing within which to repay it. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

One clause of the Lincoln Corporation Bill (the gas portion of which has already been noticed) relates to the supply of water. It is provided that, notwithstanding the provisions of section 30 of their Act of 1908, relating to the price of water sold by measure, the Corporation may require that the charge to be paid for water so supplied for domestic purposes to any building shall not be less than the sum which would be chargeable for a supply given to the occupier of such building otherwise than by meter. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Lurgan Urban District Council have, as already notified in the "JOURNAL," promoted a Bill to obtain authority for the transfer to them of the undertaking of the Lurgan Gas Light and Chemical Company, Limited. The Bill contains several clauses relating to the supply of water. If water for domestic purposes is used for stables, washing motors, &c., by means of a hose-pipe, an additional sum not exceeding 20s. per annum may be charged. Authority is asked to make bye-laws for the prevention and detection of waste, to supply meters and fittings, repair communication pipes, &c. [*Parliamentary Agents: Messrs. Lees and Co.*]

Important extensions of works are proposed in the Bill promoted by the Metropolitan Water Board. A reservoir is to be constructed at Southgate, another at Eltham, two at Bromley, and two others at Farnborough and Shoreham respectively. In connection with these works eight aqueducts or pipe-lines will be made; and there will be a well and pumping-station at Eynsford and a subway or tunnel in Camberwell. If the last-named work is not completed within five years from the passing of the Bill, the power to make it is to cease, except as to the portion which may be finished. Fifteen years are required for the other works. Full provision is made in the Bill for the protection of gas, water, and electricity mains and sewers. In the portion of the Bill dealing with finance, it is provided that, as from the date of the Act, sub-section 12 of section 22 of the Metropolitan Water Board Act, 1906, is to be read and have effect as if the sum of £2,000,000 had been referred to instead of £1,000,000; and the other provisions of the section are to be read and have effect accordingly. The Board require power to borrow the following amounts: For the purchase of lands and the construction of reservoirs, &c., £285,150; for the aqueducts or pipe-lines, &c., £365,350; and for the provision of machinery in connection with the proposed works, £32,000. For the repayment of the first-named amount the Board require sixty years; for the second, fifty years; and for the third, twenty years. Provision is made in the Bill for the purchase by the Board, by agreement with the Corporation of Hertford, of the rights and interests (if any) in the Manifold Ditch, the Black Ditch, and several other ditches or watercourses specified. [*Parliamentary Agents: Messrs. Dyson and Co.*]

A bulky Bill has been promoted by the Plymouth Corporation to consolidate, with amendments, certain of the Local Acts in force in the borough, and to confer further powers upon the Mayor and Corporation. Part III., relating to the supply of gas, has been already noticed [*ante*, p. 74]. Part II. is devoted to water. It is provided that the water undertaking as it exists at the time of the passing of the Bill is to continue vested in the Corporation and held by them. Power is given to provide and maintain water-works, lay down mains, hold lands and exercise powers for the protection of waters, and make bye-laws for the prevention of waste. The limits of supply are the borough and neighbouring parishes; and the charges for water for domestic purposes vary with the annual value of the premises supplied—ranging from 4s. where this does not exceed £5, up to 2 per cent. when it is above £100. The Corporation may supply water by meter for domestic, shipping, or other purposes; but the ordinary supply for shipping is to be at the rate of 1s. 6d. per ton, and 1s. for any fractional part of a ton. The Bill contains the usual clause as to water used for stables, motors, &c., by means of a hose-pipe. The Corporation require authority to borrow £60,000 for the construction of a conduit and water-mains, and for other purposes connected with the water undertaking; and they ask for sixty years for prepayment. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

A Bill promoted by the Rhondda Urban District Council to (*inter alia*) confer further powers upon them with respect to their gas and water undertakings, contains four clauses bearing upon the supply of water. They give the Council power to repair and maintain communication pipes, and authorize them to charge an additional sum not exceeding 20s. per annum for water used for stables, washing motors, &c., by means of a hose-pipe. [*Parliamentary Agents: Messrs. Torr, Durnford, and Co.*]

The Wolverhampton Corporation require power to construct additional water-works, extend their limits of supply, and make further provision in regard to their water undertaking. The new works comprise a pumping-station in the parish of Lapley and Wheaton Aston, in the rural district of Cannock, a service reservoir in the parish of Brewood, and two aqueducts or pipe-lines; and seven years are required within which to complete them. If, after the pumping-station is finished, a diminution is caused in the supply of water from any well or spring within a radius of two miles which is used as a source of water supply, the Corporation will make good the diminution so long as it shall continue, but not exceeding the quantity "reasonably required for the agricultural and general purposes of the premises supplied from such well or spring before the passing of the Act." It is proposed to extend the limits of supply so as to include nine parishes in the county of Stafford and two in the county of Salop. The Corporation require authority to place meters in the streets for the purpose of detecting waste or measuring water, and to enter into contracts for the sale of water in bulk. Permission is sought to borrow £80,000 for the purchase of lands and the construction of works, and £40,000 for the extension of mains, to be repaid within sixty years and fifty years respectively. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

Mr. William Newbigging and the Kalamazoo Gas Inquiry.—It was mentioned in the "JOURNAL" for the 8th ult. that the municipal authorities of Kalamazoo (Mich.) had engaged Mr. William Newbigging to act as their expert in an inquiry as to the rates charged for gas in the city. We learn from the "American Gas Light Journal" for the 11th inst. that he is to make an examination of the property of the Gas Company, investigate the conditions of gas supply, appraise the plant and distributing system, analyze the accounts, and recommend whether a new franchise shall be granted or the plant bought by the city. Referring to the matter under the heading of "Imported Opinion," our contemporary said: "Kalamazoo (Mich.) has engaged Mr. W. Newbigging, of Manchester, England, as its Engineer to make an examination of the property of the Kalamazoo Gas Company. While this action is not very complimentary to American consulting engineers, because of its inferential doubt of their fairness in matters of dispute between companies and municipalities, it may indirectly be a move of great value to the gas industry at large. We believe that a detailed report of an American problem by an internationally recognized expert like Mr. Newbigging may at last silence the agitators who are everlastingly talking about how cheap gas is sold in England."

ELECTRICAL POWER PLANTS IN GAS-WORKS: THEIR CHOICE, INSTALLATION, AND OPERATION.

By a "Gas-Electrical" Engineer.

(*Concluded from p.* 140)

Standardization.

Few factors are more conducive to low maintenance charges and to efficient working than is the policy of standardizing, so far as it is practicable, the various motors in use on a works. In laying down new drives the saving effected by accepting the lowest tender for the motor is only accomplished at the cost of "bastardizing" the plant and creating the necessity as time goes on for the maintenance of a huge, but in the circumstances absolutely necessary, stock of spare gear. Every endeavour should be made to use one manufacturer's motors. The electrical motor industry is established on a perfectly firm basis; and no difficulty exists in deciding upon one of the great firms whose names, so far as power jobs are concerned, are household words.

For ordinary stationary drives by shunt-wound motors fairly high-speed machines—say, 800 to 1000 revolutions per minute—should be used. The high efficiency of the modern chain-drive—namely, 98 per cent.—has largely contributed to the ease with which high motor speeds may be economically reduced. Slow-speed motors are bulky and expensive, and should be avoided, except for purposes where the use of reducing gear is entirely out of the question.

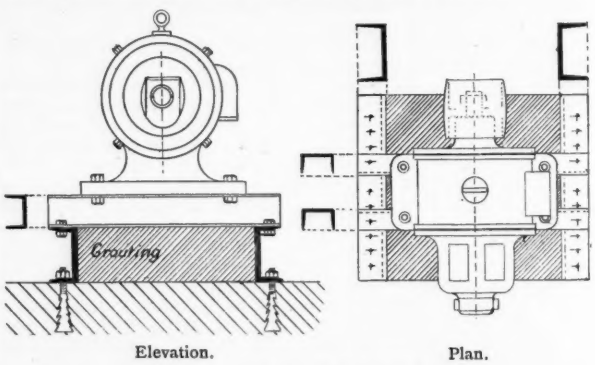
Accidents are bound to happen on the best regulated works, and even a combination of mishaps may be expeditiously dealt with if judicious standardization of the speed of the various motors renders these machines interchangeable. Spare motors may be adopted for emergency service in more than one situation: (1) By the fitting of different diameter pulleys, (2) by the inserting of a resistance in series with the shunt coils, or (3) by a judicious blending of both these methods. A spare motor should be looked upon as a stand-by for as many units of plant as the above methods will render it suitable.

Fig. 3 shows a plan and elevation of a motor-bed used on the plant with which the author is associated. This allows of motors of varying makes being used on the same job by simply changing the pitch of the cross channels, which, in the first instance, are marked off and drilled to accommodate as many types of individual machines as emergency conditions may demand the use of. Practical experience proves that the higher a motor can be set off the ground level the less dirt tends to accumulate in its interior, in addition to which inspection and cleaning are greatly facilitated where a man can work without kneeling. Both these advantages are gained by the use of the type of bed described.

Fig. 4 shows a photograph of a bed of this type. In the immediate background a stoking machine of the Fiddes-Aldridge simultaneous type may be observed, a noteworthy feature in connection with which is the plug-box, shown at the rear of the machine on a projecting bracket. In the event of a breakdown of the overhead lines, this box can be connected to, and a supply of electrical power obtained from, any one of four similar boxes situated at equidistant points along the retort-house wall by means of a wandering lead—thus allowing of the machine being used uninterruptedly while the necessary repairs are being effected to the trolley wire. The proximity of the Fiddes-Aldridge machine and its crew will give the reader a good idea of the facilities which this type of motor bed affords for cleaning and inspection. The motor—a 22 B.H.P. "Brush" machine—is practically breast high, well raised from the dusty retort-house floor.

Motor Control Gear.

It may safely be said that more breakdowns of power plants are caused by the failures of starters than are brought about by defects in the actual motors themselves; and the prospective user of electric motors cannot exercise too much care in his selection of suitable motor starting gear. The old adage of "spoiling the ship for a ha'porth of tar" is peculiarly applicable to this subject. It is no uncommon thing to see a good motor rendered unreliable and inefficient by association with an iniquitous creation of copper and German silver termed by deluded people a "starter."



Elevation. Plan.

Fig. 3.—Elevation and Plan of Motor Bed.

For series motors the barrel type controller and separate resistance element supplied by the leading electrical firms is an absolutely reliable apparatus; but this cannot be said of the many highly ornamental shunt motor starters with which the electrical market is flooded, in which everything is sacrificed to a so-called "neat and compact design." Many of these "neat and compact" starters become miniature ovens before the unfortunate motors to which they are attached are half-way up to speed; and when, after a more or less chequered existence, they come in to have their resistance elements renewed, it is usually found that everything is so hopelessly cramped and under-rated as to make it impossible to carry out a satisfactory repair.

In selecting a starter, preference should be given to a plain, substantial apparatus with renewable contact blocks and renewable grid type resistance elements fitted in such a manner as to facilitate replacements. The overload trip coil, as fitted in connection with this class of apparatus, is usually a snare and a delusion, and should be avoided; the slightest amount of dirt or

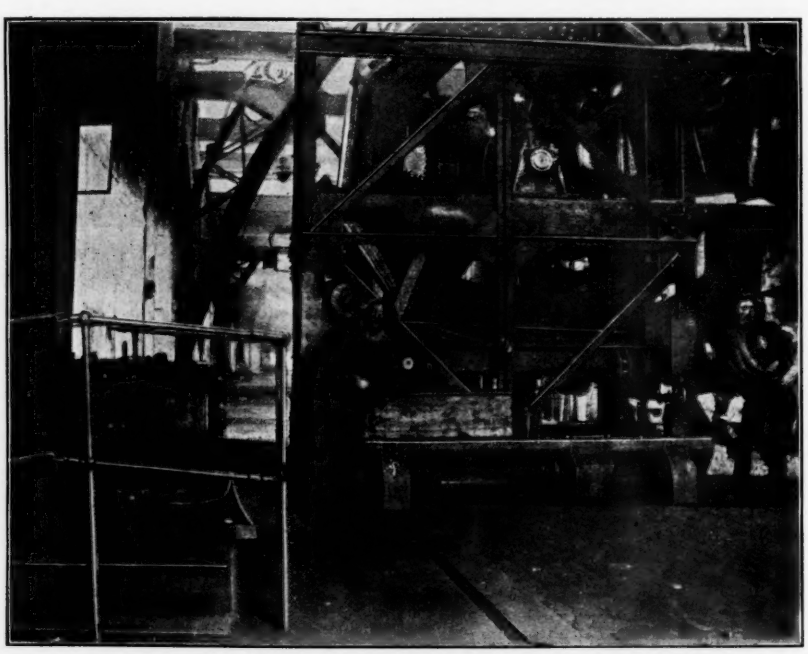


Fig. 4.—ELECTRIC MOTOR FOR WORKING A FIDDES-ALDRIDGE STOKING MACHINE.

degree of oxidization on its contacts preventing it short-circuiting the no-volt coil.

For use with reversing motors of either kind a drum type barrel controller and separate resistance is strongly recommended in preference to the elaborate control panels so often met with. The liquid type of starter has much to recommend it. It consists of a cast-iron tank containing a solution of caustic soda. The tank forms one electrode, while a second is formed by a hinged segmental piece of sheet iron, which, dipping into the solution, gradually decreases the resistance between the two electrodes. When the segmental piece is nearly immersed, the motor has attained full speed; and at this point the two poles of the starter are short-circuited by a laminated brush contact.

Unless a metallic starter is constructed with a very large number of stops, it cannot possibly give the finely-graded start which is obtainable with a liquid starter, which, it may be mentioned, is particularly suitable for creeping speeds. In connection, however, with liquid starters it is necessary to instal a field-breaking switch and "kick coil" on the motor field circuit. The function of this apparatus is to short the inductive circuit through a non-inductive resistance just before the circuit is opened—thus preventing the dangerous rise of pressure which would otherwise occur and probably damage the insulators of the field coils.

An emergency stopping switch is often a necessity on an elevator or a conveyor where the attendant is not always in the vicinity of the motor-control gear, as circumstances may arise in which considerable damage may be averted, or even human life saved, by a quick shut-down. This contingency is usually provided for by the installation of push-button switches, the functions of which are to short-circuit the no-volt coil, and so release the starter arm. These switches are more ornamental than useful, and cannot be relied upon to act. The main feeder line should be extended to those points at which it is desired to instal emergency switches and single-pole switches connected in series with them. This ensures a positive shut-down should occasion arise, and does not depend upon the good condition of the starter for its satisfactory operation.

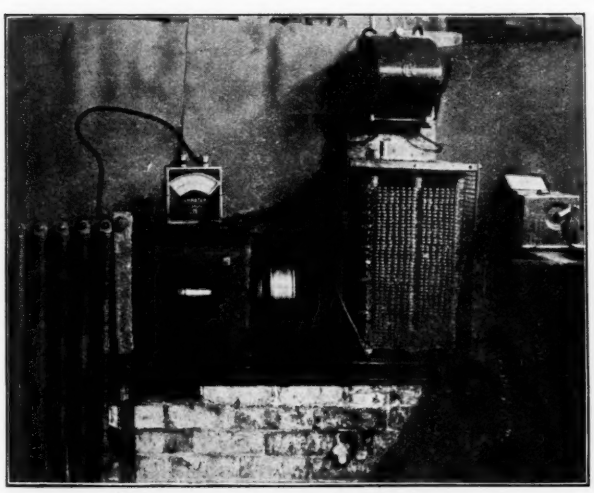


Fig. 5.—Electric Apparatus arranged for Testing.

The rating of starting gear has an important bearing upon the satisfactory working of a plant, and for all-round work it is strongly recommended that half-minute starters should be used—namely, starting switches the resistance elements of which are so designed as to carry the starting current for half-a-minute without injury. For use with retort charging and discharging machines, continuously rated resistances will probably be found to give the greatest satisfaction, and should be installed in preference to the smaller and cheaper 33 per cent. rated resistance elements, which are often more suitable for culinary purposes than for the performance of their legitimate duty. It is frequently advisable to keep a couple of resistance notches in hand during a "push," and under certain conditions a lightly rated resistance will be found to attain a dangerously high temperature.

Fig. 5 shows a photograph of a group of apparatus of a type particularly suitable for the heavy work and rough usage usually meted out to gas-works power plants. A series motor of the type used on the "Fiddes-Aldridge" machine is under test, and is connected in series with two types of resistance frames. The right-hand resistance is of the unbreakable wire grid type; while that to the left is a home-made iron wire resistance, which has been found by the writer to give excellent service under the most arduous conditions, and is extensively used on the plant under his care. Its first cost is very low, while the ease with which its resistance elements can be renewed, or its entire ohmic value altered, make it a particularly suitable standard frame for use on jobs where absolute reliability is of more importance than ornamental characteristics.

Electrical Driving of Exhausters.

In spite of the extent to which, in recent years, electrical driving has been used in connection with gas-works plants, it is a significant fact that the cases in which the electrical motor drive has been applied to the main exhausters are few and far between. The reluctance to use electricity for this purpose cannot, in the majority of cases, be put down to conservatism, but to a deep-rooted and very natural objection to place so important a function at the mercy of a power which, however suitable it is for ordinary purposes, possesses an unhappy knack of failing, due to the legitimate action of those appliances by means of which its production is controlled and protected—the fuses and circuit-breakers.

The interruption of supply due to the falling of a circuit-breaker or the blowing of a fuse is admittedly of short duration; but the failure of the "pull" on a large retort-house main, even for so short a time, is fraught with results which can only be described as unpleasant (not to use a stronger expression), to say nothing of its effect upon the nerves, and possibly upon the immortal soul, of the carbonizing foreman.

The rapid growth of the electrical motor industry, and the onerous conditions under which motors have to work, have concentrated an immense amount of experience into a very few years; and it may be safely said that an electric motor, manufactured by a first-class firm, is equally as reliable as the slow-speed steam-engine usually employed for exhauster driving—always provided that the supply of motive power can be maintained as uninterruptedly as is possible in the case of steam-engines. This, to the writer's mind, is the *crux* of the whole question, and the basis on which the practicability or otherwise of the electrically driven exhauster should be decided.

So far as regulation is concerned, it is as easy to connect a gas-governor to a properly-designed shunt regulator as to a throttle valve, in addition to which provision can be easily made for any required degree of hand regulation.

Assuming that two or more modern compound wound generating sets have been laid down, and are properly maintained, the continuity of the supply will largely depend upon the type of switch-gear installed. Where electrically driven exhausters are part of a new power scheme, the design of the switchgear should be such as to render the falling of a dynamo circuit-breaker on a feeder fault an impossibility; and it was this consideration that dictated the design of switchgear outlined in a preceding paragraph dealing with this subject. The exhauster motor feeders should be taken from the main bus bars, *viâ* a time-limit controlled circuit breaker. In lieu of the usual main fuse on the exhauster motor control gear, duplicate fuses should be installed and connected to suitable switchgear in such a manner as will enable either fuse to be withdrawn and examined without stopping the exhauster.

Operation of Plant.

It may be safely said that one of the best investments a power plant owner can make is to engage a good man to look after it for him; and to no branch of the engineering industry does this remark apply with greater force than to the plants forming the subject of this article. It is a very difficult task to even approximately estimate the loss occasioned by the breakdown for any length of time of (say) an electrically driven stoking machine in a one-machine installation. A breakdown of such a machine means manning up a retort-house for hand charging with men who, from lack of practice, have become comparatively inefficient—a factor which tends to produce a marked reduction in the "makes," to say nothing of the increased labour charges.

It may be accepted as a *sine quâ non* that if economical results or even reasonable reliability are to be obtained from an electrical power installation, a properly qualified man must be placed in charge of it. A works fitter, however fine his mechanical abilities may be, does not possess the necessary qualifications any more than does a wireman or the youth who, having served two years' apprenticeship to a local wiring contractor, blossoms out at the expiration of the time into a full fledged electrician, with an optimistic readiness to run (or rather ruin) any plant over which a misguided owner is foolish enough to give him control. There are far too many cases of inexperienced youths and incompetent handy men being placed in charge of plant simply because they are "cheap;" and this false economy is inevitably bound to recoil on their employer's head.

A discussion upon the qualifications which tend to fit a man for the charge of a plant of this description is outside the scope of this article. It may be observed, however, that ability is the outcome of well-applied experience; and responsible charge should only be given to a man who has had good practical experience in electrical and mechanical maintenance, as well as in running electrical motors, dynamos, and their controlling gear.

One of the chief recommendations of a gas-works electrician is the rapidity with which he can locate a fault and make a temporary repair to keep things going. A temporary repair in electrical work is admittedly not an attractive proposition, as it generally partakes of the nature of a "lash up;" but in this class of plant electrical principles have often to become (to a certain extent) subservient to local conditions.

It is an unfortunate fact that a strong, and, it must be admitted, natural, prejudice exists in the minds of most gas workers against electrical gear; and when a works goes over to electrical driving strong measures should be taken in order to ensure that this prejudice does not interfere with the efficient operation of the new plant. The economical possibilities of electrical driving, however well recognized by trained officials, cannot be so obvious to the average machine attendant, who looks with distrust and suspicion upon a machine which is, and ever must remain, a mystery

to him; and there will be found a great tendency to lay every trouble to which machinery is heir at the door of the unfortunate electrical motor.

Systematic inspection of the individual units of the plant will do much to keep the running costs low and ensure freedom from breakdowns. The examination should be thorough, as superficial inspection generally fails to reveal incipient defects. Every week each motor should be opened-up and the following routine observed: (*a*) Oil wells flushed and refilled; (*b*) brushes inspected and, if necessary, renewed; (*c*) commutator cleaned; (*d*) motor blown-out and cleaned; (*e*) clearances noted and recorded; (*f*) insulation resistance taken and recorded; (*g*) the running light, and normal load current taken and recorded. This list may seem rather formidable; but the work enumerated can be carried out well within an hour. Each motor should have its particular day for cleaning and inspection; and in an installation comprising a large number of motors, it is advantageous to keep a record of each motor by means of a card system. Each card should bear the maker's name, brake-horse-power, speed pressure, and shop number of the motor. For the guidance of cleaners, &c., each motor should be allotted a works number, which may be painted in large white letters on the carcase, and which should also be shown on its card.

The records of inspection should be entered on this card, the no-load current, full-load current, and insulation resistance, being plotted graphically. These cards should not be regarded as an elaborate and more or less superfluous record of the state of the motors themselves, but rather as an invaluable check upon the performance, and hence upon the efficiency, of the various units of the plant driven by these motors. The use of integrating watt-meters on the various circuits will, of course, enable even closer check to be kept on the plant; and in the case of chargers, conveyors, and elevators will (the generating costs being known) provide a record of the cost per ton of handling material in bulk.

Generally speaking, it may be observed that the larger a plant is the greater will be the benefit derived by the installation of recording watt-meters on both the dynamo and the feeder circuits. Daily readings of the former meters checked into the readings of the gas-meters on the main dynamo engines will reveal any increased consumption per unit for which defects in the engines may be responsible, while under normal conditions of working the average consumption per hour on the feeder meters will give a comparative record of the state of the individual units of plant.

Insurance.

The extent to which an undertaking should insure its power plant must be largely determined by the class of man in charge of the plant—a subject that has already been dealt with in the course of this article. It is freely admitted that the most valuable return for the annual premium is the periodical inspection by an electrical expert to which the various units of the plant are subjected, and the report that follows upon this inspection. On the other hand, it must be remembered that if a plant is in the charge of a qualified engineer, periodical inspection by an outside expert can only be regarded as a superfluous proceeding.

In a plant of the type under consideration, the loss occasioned by the failure of a motor is not always of a character that can be made good by a claim upon the insurance company. General inconvenience, extra labour charges for hand firing, and, most likely, a diminution in the "make" occasioned by the stoppage of (say) a stoking machine, cannot be made the basis of a claim under the insurance policy; while the actual remedy of the fault which occasioned the stoppage may take a very short time, and cost practically nothing. Broadly speaking, the more expert the engineer in charge of the plant is, the less necessity exists for wholesale insurance against breakdown. The proprietor of a small factory driven by one or two motors worked on public supply mains and looked after by a handy man should certainly insure his motors and derive the advantage of the expert assistance which is always at his service. The large power plant owner who pays a good salary to a good man to run it for him may safely let his insurance policy stop at his engine stop-valves.

In General.

The engineer who adopts electrical driving cannot be warned too strongly against dumping an engine and generator down in the first convenient site that suggests itself. Electricity is often introduced into a works as the natural result of the installation of an electrically operated retort-charging machine; and although primarily intended for operating perhaps only one machine, it must be remembered that the first generating set will in all probability form the nucleus of a plant which will one day be supplying the power required by most of the works. A steadily growing generating plant placed on an unsuitable site must ever be an eyesore. The writer does not suggest that the prospective user of electricity should "dip into the future, far as human eye can see;" but he may content himself by just looking ahead a few years, and form a rough estimate of what his requirements are likely to be.

The ease with which the electric motor lends itself to installation often leads to its being so placed, during the erection of new plant, as to render it a most difficult matter to clean, inspect, or change it. In designing new plant a good get-at-able position should be selected for the motor; and it is usually no trouble to scale-in a length of joist with a hole in its end for the reception of a shackle bolt immediately above the motor in order to facilitate lifting it out. This simple fitment will save its cost many times over on the first exchange job.

The Question of Policy.

In conclusion, the writer would like to touch upon a question which is bound to suggest itself to every gas engineer who is considering the question of putting down an electric power plant—namely, the question as to whether it is a wise policy for an undertaking in active competition with an electric supply authority to use electric motors on its works. There is always the possibility of the consumer who is being canvassed to instal a gas-engine asking "awkward" questions. Now, in very truth, need such questions be considered "awkward?"

It may be taken for granted that the progressive gas engineer who lays down an electric power plant and transmission system does so for the simple reason that he is convinced that, by so doing, he is meeting his own requirements in the most economical manner. In other words, he has reduced the whole matter to the basis of pounds, shillings, and pence—a basis which any business man would understand. It must be met and defeated on the grounds of £ *s. d.*; and the best answer to the consumer who twits the gas official on the fact that his own undertaking uses electricity is: "If you could buy electrical energy as cheaply as our gas can generate it, I should not waste my time in trying to persuade you to put down a gas-engine."

A publication recently issued by a leading firm of electric motor manufacturers gave about twenty so-called reasons why an electric motor should be installed in preference to a gas-engine. Some of the reasons were purely imaginary, some were simply silly, while others would only appeal to a naturally slovenly machinery attendant. The only ones that had any degree of truth in them were those that concerned the respective initial outlays and the cost of lubricants—factors which can only be considered in conjunction with running costs, of which latter all mention was carefully omitted. In short, it was obvious that the individual responsible for this attack upon gas-engines had taken for comparison a most modern motor and a remarkably antiquated specimen of a gas-engine.

As a result of a wide, a varied, and, he hopes, an unbiassed, experience of both types of prime movers, and of a painstaking series of observations taken over long periods and under working conditions, the author has no hesitation in making the following assertion. Taking into consideration interest on capital outlay, depreciation, costs of lubricating oil, gas, and electricity (insurance and attendance may be taken as the same), gas of average calorific value at 2s. per 1000 cubic feet is the equivalent (on the basis of cost per B.H.P. hour) of electricity at about 1d. per unit in the case of small engines; while in the case of (say) a 50 B.H.P. engine, electricity would have to be retailed at ¾d. per unit in order to compete with gas at 2s. per 1000 cubic feet.

The fact that the gas supply authority are themselves users of electric energy should not be treated as a great secret, and only admitted in a shamefaced, apologetic sort of manner. Any trained engineer must admit that, where a large works or factory has to be supplied with power for driving several scattered units of plant, the electrical system of transmission is the best, the most flexible, and the cheapest. The consumer is usually a business man who can take an intelligent grasp of his power cost problems if they are put to him in the language of pounds, shillings, and pence. If his plant is a small one contained in a limited space, this language will convince him that a single gas-engine will serve his interests. If, on the other hand, he has a large works with scattered units of plant, then at the local gas-works he can be shown a practical running solution to his problem. In either case, if the matter be intelligently handled, business will result.

In short, the gas engineer need not fear that he may lose prestige by the putting into practice of his progressive ideas. He lives in a progressive age, his training teaches him that "the old order changeth, yielding place to new." His requirements can best be met by the use of electric power, and the highly efficient gas-driven generating sets which he employs to this end may well be taken as an indication of the trend of modern practice, and as forerunners of that new era when the electrical energy required by the nation will be generated by internal combustion engines, and our "national black assets"—coal—be carefully conserved by the winning back of those residuals which are now blown up the stacks of a host of wasteful steam-generating stations.

Additions to Reeson's "Gas and Water Acts."

Many of our readers are doubtless acquainted with the exceedingly useful volume published by Mr. Joseph Reeson, containing a collection of the Acts relating to gas and water supply passed between 1817 and 1902. After the first appearance of the book, Mr. Reeson enhanced its utility by issuing separate leaves, for insertion, containing notes relating to subsequent additions, repeals, and amendments. He has now sent us the latest of these supplements, containing the heads and summaries of changes necessitated by the passing of the Gas Light and Coke Company's Act of last session. All the new clauses are given in full; so that this collection of additions, while being much handier for reference than the Act, especially in connection with the book, is as complete as the Act itself, while its price (1s.) does not exceed that of the Act. Previous additions to Mr. Reeson's book have been noticed in the "Journal."

EVENT AND COMMENT.

[Communicated.]

Utilizing the Surplus Gas of Coke-Ovens.

The Yorkshire Electric Power Company are again in Parliament with a view to obtaining powers for the supply of a large area in the West Riding of York. It is in this connection that the Company have been principally brought before the notice of gas engineers; but it is in another direction altogether that the writer is referring to them in the present note. The policy of the Company is apparently to erect a power station in a new district where a prime mover can be obtained at a low cost, and where, moreover, there is possibility of considerable expansion. They at any rate are keenly alive to the possibilities of the better utilization of the surplus gas produced at bye-product coke-ovens. Some little time ago, the Company erected a power station at Barugh, near Barnsley, in close proximity to the bye-product coke-oven plant of the Old Silkstone Collieries. A battery of eighty regenerative ovens is installed here; and taking the average coking capacity of 6 tons of coal per oven per working day, and 6000 cubic feet of surplus gas per ton of coal, we get 2,880,000 cubic feet of gas available per day for power purposes. The benzol has already been extracted from this gas, so that its calorific value will probably be about 450 to 500 B.Th.U. per cubic foot.

As pointed out in these notes a fortnight ago, it is only in exceptional cases that a coke-oven plant can consume the whole of its surplus gas, owing to the fact that there are periods when there is no demand for it. An electric supply company, however, has a continuous load day and night. The load will, of course, fluctuate during the twenty four hours, but in most cases even the minimum load represents an appreciable amount. In the present instance, the Yorkshire Electric Power Company put down a power station at the coke-ovens and undertook to take the surplus gas produced at an agreed price. The colliery people were therefore assured of a certain outlet for their gas at all times. The writer does not know the basis on which the value of the gas was arrived at in this particular case, but in other instances with which he is acquainted the following has been taken. Assume that a coal having a calorific value of 13,000 B.Th.U. per pound, and costing at the boilers 10s. per ton, is being used for steam raising purposes. This gives per ton of coal 29,120,000 B.Th.U., or approximately 243,000 B.Th.U. per 1d. As this is coal at a colliery, the 10s. per ton should include the cost of firing. Now, taking the gas-firing system. To get an equivalent number of British thermal units to the boiler, using gas of (say) 480 B.Th.U. per cubic foot, we should require approximately 500 cubic feet; so that an equivalent price for gas on a British thermal unit basis would be 2d. per 1000 cubic feet. There is, in addition, the charge on the cost of the gas-main, burners, &c., to take into account. With a good gas-burner, however, the increased efficiency, as compared with a coal-fired boiler, should more than compensate for these slight additional charges. On this basis, therefore, 2d. per 1000 cubic feet is usually allowed on coke-oven plants as the value of the surplus gas. It is questionable, however, if the Electric Power Company would pay anything like this price, using the gas for boiler-firing purposes. From the point of view of power alone, it would be far more economical to use the gas in gas-engines—the latter, in turn, to generate electric current. In this way twice as much power could be obtained from the gas as would result by the consumption for steam-raising purposes. With a good type of burner, about 3¼ cubic feet of gas are required to evaporate 1 lb. of water. With a modern type of gas-engine, about 18 to 20 cubic feet of gas are required per brake-horse-power-hour. In the power station at Barugh, the gas is used for boiler-firing purposes, as no doubt the Power Company had good and sufficient reason for preferring this type of prime mover to gas-engines. In other parts of the country, particularly in Durham, the waste heat from coke-ovens is taken over by electric supply companies; and this movement is growing stronger as the potentialities of surplus coke-oven gas are being realized. Eventually, when beehive ovens are completely replaced by bye-product ovens, an enormous amount of cheap power will be available.

The development of the producer-gas industry, particularly in connection with bye-product recovery, and also the introduction of ovens which can be heated by producer gas, is a distinct advance in the campaign against waste. Every period of depression in the iron trade has a corresponding reaction on the coke market; and low prices for coke cause producers to look in other directions for the maintenance of their revenue.

Restrictions on the Sale of Benzol.

In view of the fact that numerous representations have been made to them, the Committee on the Supply of High Explosives have modified somewhat the specification governing the quality of benzol which can be sold. A permit for sale or delivery is now required for all benzol which distils less than 95 per cent. at 90° C. In the original proclamation a temperature of 84° C. was specified; but on account of the representations above referred to, this temperature has been raised to 90° C. It is further stated that permits will be given without delay, and also that the Committee have no objection to solvent naphtha or xylol being added to the benzol prior to sale, provided that the toluene has been removed. It seems therefore that the Committee are disposed to be quite reasonable in the matter, and are not desirous of putting unnecessary obstacles in the way of the producer. There will, of course, be some inconvenience attached to the proceedings; but in times such as we are passing through at present, matters of national importance cannot be allowed to suffer on account of private inconvenience. One result of the restrictions, coupled perhaps with the expected increase in the demand for pure coal-tar products for the aniline dye industry, will be to direct attention to commercial processes for the production of pure benzene, toluene, &c., by fractional distillation of the crude benzol manufactured in coke-oven plants. This is a branch of the industry which has developed very little in this country—at any rate, so far as coke-oven plants are concerned. The writer is not aware of a single coke-oven plant in the country where the manufacture of the pure product is carried out. There are a few instances of plants making refined or washed 90 per cent. benzol. This distils from 70 to 85 per cent. at 84° C. in some cases, whereas pure benzene should distil almost completely between 80° and 81° C. The process of manufacture is comparatively simple; and as soon as the demand justifies action, we shall no doubt see that ample supplies are forthcoming.

The Progress of Bye-Product Coking.

The recently issued Home Office Report—Part III.: Mines and Quarries—contains some interesting information regarding the status of bye-product coking in this country. The report is for the year 1913, which was a busy one for coke producers; there being an increase of over 2 million tons on the production of the previous year. One result of this is that there was comparatively little falling off in the number of beehive ovens in operation. It is only at busy times, when prices are high and the bye-product ovens unequal to the demand, that beehive ovens can justify their existence. In the slack times they must feel the pressure of competition, and must eventually be compelled to withdraw in favour of the more economical and scientific bye-product oven. The number of ovens in operation during the year was 13,167 beehive ovens and 7839 bye-product ovens, producing together 12,798,996 tons of coke for the year. A fair average carbonization for a bye-product oven is 1500 tons per annum; and on this basis, the bye-product ovens in 1913 would account for 11,758,500 tons of coal. For a beehive oven 600 tons per annum is a fair average; and on this basis the beehive ovens would carbonize about 8 million tons of coal in the year. Taking as the average yield of coke 65 per cent. of the weight of coal, we get about 20 million tons as the amount carbonized in all coke-ovens during the year. Durham and Yorkshire represent the principal coking counties; and we may assume that the yields obtainable when the coal is carbonized in a good regenerative coke-oven would be as follows: Coke, 69 per cent., tar 4 per cent., sulphate of ammonia 1·3 per cent., benzol 2½ gallons per ton of coal, surplus gas 5500 cubic feet per ton of coal. Carbonized in coke-ovens of the beehive type, the only yield would be 60 per cent. of coke. On the figures given above, we get therefore as the actual and possible yields during 1913 from the 8 million tons of coal carbonized in beehive ovens the following:

	Actual (in Beehive Ovens).	Possible (in Bye-Product Ovens).
Coke	4,800,000 tons	5,552,000 tons
Tar	*Nil*	320,000 ,,
Sulphate	*Nil*	104,000 ,,
Benzol	*Nil*	20,000,000 gallons
Gas	Some waste heat	44,000 million cub. ft.

What an enormous loss is represented by these figures for one year's working alone! There is, therefore, ample room for conservation of our national resources. It does not need anything in the way of new and untried methods, but only the application of existing and well-proved processes.

Ammonium Chloride as a Gas-Works Bye-Product.

In the "Zeitschrift für angewandt Chemie" [Vol. XXVII., p. 518], Herr W. Strommenger had an article dealing with the production of ammonium chloride in gas-works, coke-ovens, &c. The author pointed out (according to an abstract of the article in the "Journal of the Society of Chemical Industry") that the working-up of the ammoniacal liquors into pure ammonium chloride, instead of into crude ammonium sulphate, is especially desirable in view of the introduction of synthetic nitrogen compounds as manures in competition with the older sources of supply. For this purpose, the liquors, which already contain some ammonium chloride, are treated with a slight excess of hydrochloric acid, and the decomposition of the other ammonium salts and the oxidation of the iron present are facilitated by a current of air. The sulphur precipitated during this process is almost pure, and forms a valuable bye-product. A slight excess of ammonia is added to the filtered liquors to precipitate iron and other impurities. The filtrate is neutralized with hydrochloric acid, treated with sufficient common salt to convert all the undecomposed sulphate into chloride, evaporated to dryness, and ammonium chloride separated by sublimation—leaving a residue of sodium sulphate mixed with small quantities of sodium chloride and carbon (from the organic impurities). Recrystallization of the sublimate is for most purposes unnecessary; but the innermost layers are liable to contain traces of volatile organic matter, which, although not recognizable by analysis, cause the crystals to darken on exposure to air and light. A single crystallization completely removes them.

DETERMINATION OF THE PERCENTAGE OF TOLUENE IN COMMERCIAL TOLUOL.

By HAROLD G. COLMAN, D Sc., Ph.D.

WE have received from Dr. HAROLD G. COLMAN a *brochure* on the subject of the quantity of toluene contained in commercial toluol. It is accompanied by a letter in which Dr. Colman explains that, in view of the recent rise in the price of pure toluene, and the national importance which the supply of this commodity has assumed, he has been engaged for some time past in endeavouring to arrive at a method by which its percentage in commercial toluol can be quickly and accurately determined. The result of his experiments is embodied in the pamphlet, which Dr. Colman has courteously given us permission to reproduce.

In devising a test for the determination of the amount of toluene in commercial toluol (consisting chiefly of a mixture of toluene with benzene and xylene), the object aimed at has been to work out a test complying as far as possible with the following conditions:

(1) The results obtained should have a reasonable degree of accuracy.
(2) The time required for carrying out the test should be as short as possible, consistently with fair accuracy of results.
(3) The apparatus employed in the test should be such as can be obtained readily.

As the result of a large number of distillations of varying mixtures of known amounts of pure benzene, toluene, and xylene, carried out in an ordinary Wurtz distilling flask, it was found that if the distillation is carried out under uniform conditions, it is possible to ascertain, with reasonable accuracy, the percentage of toluene in these mixtures by the determination of the fractions (*a*) boiling below 105° C. and (*b*) boiling above 117° C. Further experiments with similar mixtures of pure benzene, toluene, and xylene, but also containing small quantities of the other substances, often present to a limited extent in commercial toluol—such as carbon bisulphide, paraffin hydrocarbons of similar boiling point, and cumenes—showed that the presence of these does not materially influence the results obtained. A table constructed from the results obtained with the mixtures of pure benzene, toluene, and xylene may, therefore, be employed with reasonable accuracy in the determination of the percentage of toluene in commercial toluol which has been properly washed with caustic alkali and sulphuric acid; this being distilled under the same conditions as were employed with the pure mixtures, and the percentages boiling below 105° and above 117° ascertained.

In the accompanying table, drawn up from the results of these experiments, the percentages boiling below 105° are given in order horizontally from left to right, and the percentages above 117° in order vertically from bottom to top. The percentage of toluene is found in that place in the vertical column above the figure showing the percentage below 105° which is on a horizontal line with the figure showing the percentage above 117°—the quantities of the fractions found in the test being taken as the nearest whole per cent., and the toluene result given in the nearest whole per cent. With a fractional part of 0·5 or over, the next highest whole per cent. is taken; and with a fractional part below 0·5, the next lowest whole per cent. is taken.

This table only holds good generally for samples containing from 50 to 75 per cent. of toluene, and for such as give at least 5 per cent. and not more than 50 per cent. either below 105° or above 117°. In the great majority of cases, the commercial samples fall within the limits named; but by a simple modification, the exceptional samples can also be analyzed in a similar manner.

Details of the results obtained in the above-mentioned experiments and of the manner in which the table has been constructed will be published shortly.

Mode of Carrying-out the Test.

APPARATUS.

A standard Engler 100 cc. distillation flask, as employed in the petroleum industry, having the following dimensions:—

Diameter of bulb	6·5	centimetres
Length of neck	15·0	"
Diameter of neck	1·6	"
Length of side tube	10·0	"
Angle of side tube	75°	

Round bottomed flask of 150 to 200 cc. capacity.

A Young twelve-bulb "pear" fractionating column or other efficient column.

Efficient water-cooled condenser, such as an 18-inch Liebig condenser.

Set of 100 cc. graduated cylinders.

Thermometer registering from 50° to 150° C., and graduated in one-fifth degrees.

Correction of 100 *cc. Cylinders.*—The graduations of the 100 cc. cylinders sold are sometimes incorrect to the extent of 1 cc. The cylinders employed must be standardized by running into them known quantities of liquid—preferably toluene—from an accurate burette.

Correction of Thermometer.—Each day before testing, the thermometer correction must be ascertained by placing it in a distillation flask with the top of the bulb just below the side tube, and boiling distilled water in the flask. The difference between the thermometer reading and 100° is taken as the correction of the thermometer. Thus, if the water is found to boil at 99·5°, 0·5° must be *added* to the thermometer readings; and if the boiling point is found to be 100·5°, 0·5° must be *deducted* from the readings. This correction includes that due to variations of barometric pressure, and inaccuracies of the thermometer. Should the barometric pressure vary considerably during the day, the correction should be re-ascertained in the same manner.

Method of Distillation.

Distillation flask and condenser to be washed out with the toluol to be tested, and allowed to drain.

100 cc. of the toluol (at 15·5° C.) to be tested poured into flask from graduated cylinder; the latter being drained out only.

Small naked flame under flask, with wire gauze screen to protect flame and bulb of flask from draughts.

Top of thermometer bulb just below side tube of distillation flask.

Rate of distillation, two drops per second from end of condenser, the distillates being collected in 100 cc. cylinders.

When the thermometer reaches 105° C. (corrected), the heating is stopped; the condenser allowed to drain; and the receiver changed. The distillation is continued till the thermometer reaches 117° C. (corrected). The heating is then stopped; the condenser allowed to drain; and the residue in the flask, after complete cooling, drained into a 100 cc. cylinder. The number of cc. distilling (1) below 105°, (2) between 105° and 117°, and (3) above 117° to be read off at a temperature approximating to 15° C. The combined amounts of the three distillates should not be less than 99·5 cc.

From the amounts boiling (*a*) below 105° and (*b*) above 117°, the percentage of toluene in the sample is found, subject to the correction for paraffin content specified below, by means of the accompanying table. Thus if the percentage found below 105° is 39 and that above 117° is 13, the percentage of toluene in the sample is 65.

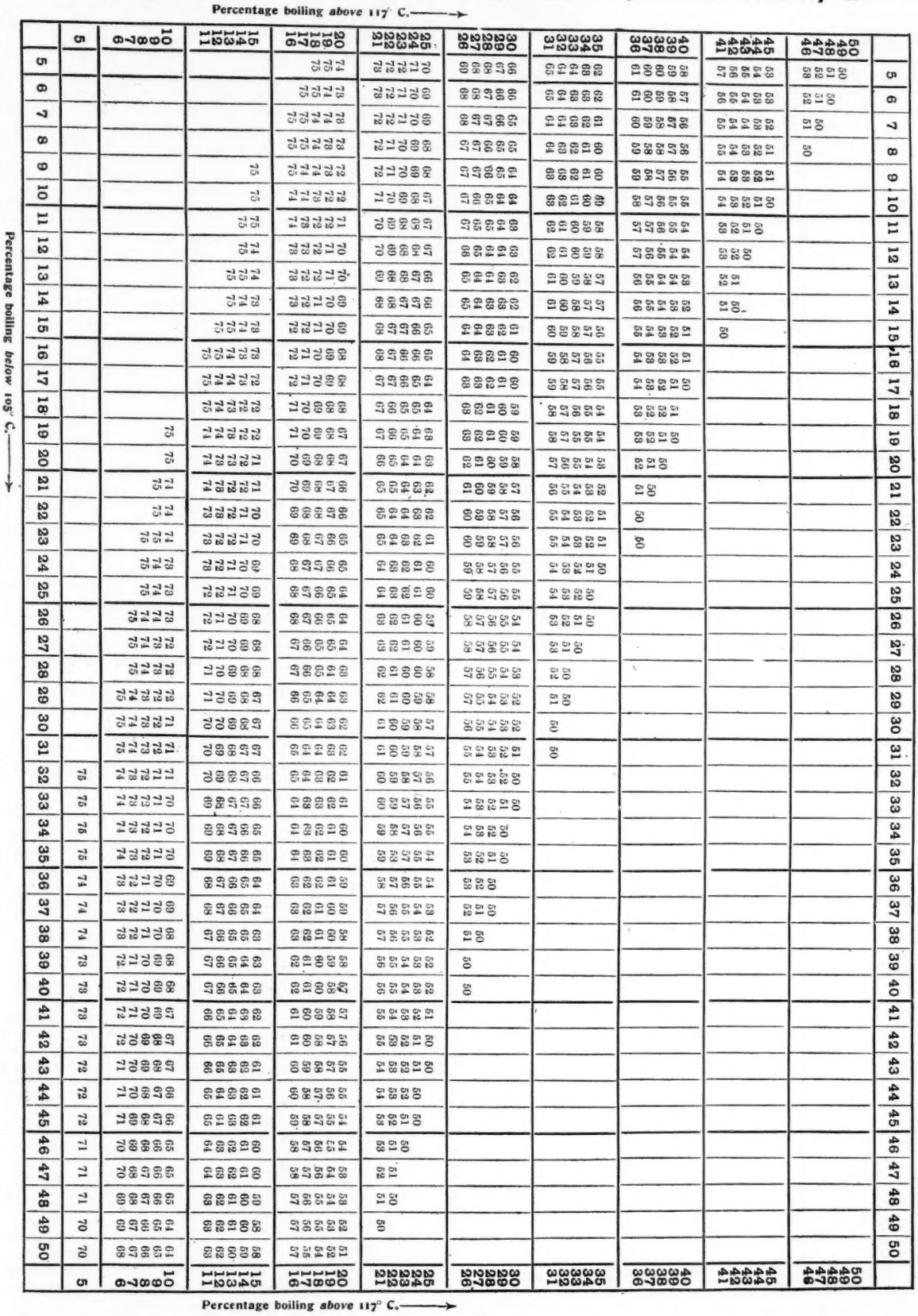
The table only holds for crude tuluol samples containing 50 to 75 per cent. of toluene, and for such as give not less than 5 per cent., or more than 50 per cent., either below 105° or above 117°. Most commercial samples fall within these limits, but in the exceptional cases, a modification of the method must be adopted. The exceptional cases are of four classes:

(1) The percentage boiling *either* below 105° *or* above 117° may be below 5. In this case 90 cc. only of the sample are taken and mixed previous to distillation with 10 cc. of pure benzene, if in the first test the distillate below 105° has been found less than 5 per cent., or with 10 cc. of xylene (boiling at 136° to 143°) if the amount boiling above 117° has been found below 5 per cent. The mixture is then to be distilled exactly as prescribed, and the percentage of toluene in the mixture found by the table. The figure thus found is the number of cc. of toluene in 90 cc. of the original sample; and the percentage of toluene in the latter is found by multiplying this figure by 100 and dividing by 90. Thus if the first test showed less than 5 cc. below 105°, and on testing a mixture of 90 cc. of the sample with 10 cc. of benzene, the toluene figure was found by the table to be 74, the percentage of toluene in the original sample is $74 \times \frac{100}{90} = 82$ per cent.

(2) The percentage boiling *both* below 105° *and* above 117° may be so low that there is no corresponding entry in the table. In this class, which includes samples containing high percentages of toluene, 80 cc. of the sample are taken, and mixed with 10 cc. of pure benzene and 10 cc. of xylene (boiling at 136° to 143°), and the mixture distilled as prescribed. The figure in the table corresponding to the amounts of distillate found below 105° and above 117° give the number of cc. of toluene in 80 cc. of the original sample; and the percentage of toluene in the latter is found by multiplying this figure by 100 and dividing by 80. Thus if a sample after mixing with 10 cc. of benzene and 10 cc. of xylene showed as a result of distilling the mixture that the percentage of toluene in the latter was 74, the percentage of toluene in the original sample is $74 \times \frac{100}{80} = 92$ per cent.

(3) The percentage boiling above 117° may be so high that there is no corresponding entry in the table. In this class, where the fraction boiling above 117° is very high, 80 cc. are taken and mixed with 20 cc. of pure benzene previous to distillation. The figure found in the table from the percentages below 105° and

TABLE FOR ASCERTAINING THE PERCENTAGE OF PURE TOLUENE IN COMMERCIAL TOLUOL FROM THE PERCENTAGES OF THE FRACTIONS BOILING *BELOW* 105° C. AND *ABOVE* 117° C.



above 117°, multiplied by 100 and divided by 80, gives the percentage of toluene in the original sample.

(4) The percentage boiling below 105° may be so high that there is no corresponding entry in the table. In this class, which comprises samples containing relatively high percentages of benzene and low percentages of toluene, 80 cc. of the sample are taken and mixed with 20 cc. of pure toluene previous to distillation; and the percentage of toluene in the mixture obtained from the percentages distilling below 105° and above 117° in the prescribed manner. From the figure thus found must be deducted the 20 cc. of toluene added, and the difference represents the amount of toluene contained in the 80 cc. of the original sample taken. The percentage of toluene in the latter is found by multiplying this difference figure by 100 and dividing by 80. Thus if 80 cc. of the sample after mixing with 20 cc. of toluene were found to contain 57 per cent. of toluene in the mixture, the amount of toluene derived from the 80 cc. of the sample is $58 - 20 = 38$; and the percentage of toluene in the original sample is $38 \times \frac{100}{80} = 48$ per cent.

Determination of Paraffin Content of the Toluene Fraction Obtainable from the Commercial Toluol.

The percentages of toluene determined in the prescribed manner by the distillation test, will include paraffin hydrocarbons of a

boiling point approximating to that of toluene, when these are present in the commercial toluol. The amount of such paraffins is determined in the following manner, and a corresponding reduction made from the percentage of toluene as found by the distillation test.

100 cc. of the sample are placed in a round-bottomed flask of 150 to 200 cc. capacity, fitted with a suitable fractionating column such as a Young twelve-bulb "pear" column, and distilled at the rate of one drop per second from the end of the condenser. The fraction distilling between 107° and 115° (corrected) is collected separately, and its specific gravity at 15·5° C. ascertained by any method giving results accurate to the third place of decimals. For every 0·001 that the specific gravity is found below 0·868, a reduction at the rate of ¾ per cent. is to be made on the amount of toluene found by the distillation test.

Thus if the percentage of toluene found by the distillation test is 70, and the specific gravity of the fraction 107° to 115° obtained in the prescribed manner is 0·864 at 15·5°, $4 \times \frac{3}{4} = 3$ per cent. of the figure shown by the distillation test is to be deducted. The corrected percentage of toluene, allowing for paraffin content, is therefore found by multiplying 70 by 100 − 3, or 97, and dividing by 100 = 68 per cent.

Sulphuric Acid Test.

90 cc. of the sample shaken with 10 cc. of 90 per cent. sulphuric acid for five minutes, should not give more than a light brown colour to the acid layer.

SALE AND EXPORT OF BENZOL.

War Office Regulations as to Testing—A Modification.

WRITING from the High Explosives Department of the War Office, Storey's Gate, S.W., Mr. R. Sothern Holland says he is instructed by Lord Moulton (the Chairman of the Committee on the Supply of High Explosives) to refer to the circular-letter dated Dec. 24, enclosing a notice specifying the test governing the issue of permits for the sale or disposal of benzol. [This circular and notice were published in the "JOURNAL" for Dec. 29, p. 727.] In view of the representations that have been made to him, Lord Moulton has decided for the present to allow benzol to be sold or delivered in this country without any permit being required, provided that 95 per cent. distils over below 90° C., instead of 84° C., as specified in the notice. A revised notice, which cancels and supersedes the former one, will be found below.

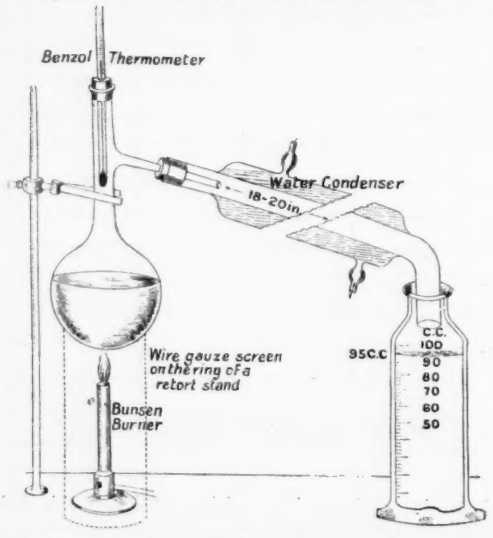
In view of the misunderstanding which appears to have arisen in regard to samples which do not conform to the test, Mr. Holland is directed to call attention to the second paragraph of "Instructions as to Sale and Export."

No objection will be raised to the addition of solvent naphtha or xylol to the benzol, subsequent to sampling, provided that the benzol has passed the specified test.

War Office Test on the Sale and Delivery of Benzol.

APPARATUS.

A distillation flask with side tube, the bulb (preferably coppered) having a capacity of about 150 to 180 c.c. The neck about 5 inches long, and the side tube passing out about the middle of the neck. An efficient condenser, such as a water-cooled condenser, about 18 inches long. Receiver, a 100 c.c. graduated cylinder. A corrected benzol thermometer.



The flask and condenser to be washed with the benzol to be tested, and allowed to drain. Then 100 c.c. of the benzol to be poured into the flask from a graduated cylinder, and drained out only. A small naked flame under the flask, with wire-gauze screen to the flame, to protect it from draughts. The rate of distillation to be two drops per second from the end of the condenser. The top of the thermometer bulb to be ½ inch below the side tube of the distillation flask.

When the thermometer shows 90° C. with the barometer at 30 inches, the heating is stopped, the apparatus is allowed to cool, and the volume of the distillate read off. The flask is then drained into the measure, and any shortage from 100 c.c. is considered as distillate and added to the volume so read.

CORRECTION OF THERMOMETER EMPLOYED.

Each day, previous to testing, the necessary correction of the thermometer used shall be ascertained in the following manner: The thermometer shall be placed in a distillation flask similar to that employed for the benzol test, and in a corresponding position; distilled water shall be then boiled in the flask, and the difference of the thermometer reading from 100° shall be taken as the correction to be adopted. Thus, if, for example, the boiling-point of water taken in this manner is shown as 99·5° on the thermometer, 0·5° is to be added to the readings of the thermometer; if the boiling-point of water is shown as 100·5°, then 0·5° is to be deducted from the thermometer readings. This correction includes that required for variations from normal barometric pressure, and errors due to inaccuracy of thermometer, &c. Should the barometric pressure vary considerably during the day, the necessary correction should be re-determined in the same manner.

INSTRUCTIONS AS TO SALE AND EXPORT.

If 95 per cent. or over is thus obtained as distillate, the benzol may be sold or delivered to a purchaser in this country without any permit being required, subject to its passing the specific gravity test below mentioned; but the Committee reserve the right, if they think fit, to require evidence that these regulations are being complied with.

If less than 95 per cent. is thus obtained as distillate, or if the specific gravity does not meet the conditions mentioned below, a permit will be required before any deliveries can be made. These permits are obtained by applying to the Secretary, High Explosives Committee, who will require notice of the amount of distillate so obtained and particulars of the specific gravity. These particulars, together with a 250 c.c. (or 8 oz.) sample of the benzol, must also be sent to Dr. P. E. Spielmann, F.I.C., Institute of Chemistry, Bloomsbury Square, London, W.C., with a label in duplicate attached to each sample. The applicant will then be informed by the Committee whether a permit will be granted.

If it is desired to export the benzol, it must first be tested in the same manner, and the application for an export permit must be sent to the Secretary, as above, with full particulars of the test and the specific gravity, together with a sample to Dr. Spielmann, as above mentioned.

The specific gravity of the sample taken from the benzol before distillation at a temperature of 15° C. (60° Fahr.) must be between ·870 and ·890.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

A Meeting of the London and Southern District Junior Gas Association was held on Friday evening last, at the Westminster Technical Institute, Vincent Square, S.W. Mr. JAMES HEWETT (the President) occupied the chair. That the attendance was somewhat below the average is hardly to be wondered at, when it is remembered that the newspapers have described Friday as "the worst day experienced in London for years"—a description in which those who were out that evening will concur.

MR. T. F. CANNING'S PROMOTION.

The PRESIDENT, at the outset of the proceedings, referred to the recent appointment of Mr. T. F. Canning to the position of Engineer and Manager of the Weymouth Gas Company, in succession to Mr. D. F. Colson, who resigned the post to be free to follow his military duties. Mr. Hewett said he felt sure the members would like the Secretary to send a letter to Mr. Canning congratulating him on his promotion to a senior position from the ranks of the Junior Association. They were all very pleased indeed to hear of his success. Mr. Canning had been for the last seven years Assistant Engineer and Manager to the Ilford Gas Company, under Mr. W. B. Farquhar, who would be remembered by some of those present as an old member of their Association.

THE ANNUAL DINNER CANCELLED.

Another announcement made by the PRESIDENT was with regard to the annual dinner of the Association, which, according to the programme, had been fixed to take place on the 20th prox. He stated that, in the unhappy circumstances now prevailing, the Council had come to the conclusion that the better course would be to cancel the dinner this year; and they were confident that the members generally would support them in this view.

COKE.

Professor VIVIAN B. LEWES was present to fulfil a promise that he would lecture to the members; and in calling upon him to do so, the PRESIDENT pointed out that he is one of the Patrons of the Association. To the lecture, which he then proceeded to deliver in his own inimitable style, Professor Lewes had given the brief title of "Coke;" but it will be seen that it dealt also, though in a lesser degree, with other matters. What he had to say was followed with the closest attention by all present; and for the sake of the absentees, it is to be regretted that a larger number were unable to turn up. The lecture is reported *in extenso* on pp. 201-4.

THE REMOVAL OF CARBON BISULPHIDE FROM COAL GAS BY HEAT.

Mr. E. V. Evans's Paper before the Society of Chemical Industry.

In the "Journal" for the 15th ult. (p. 602), an abstract was given of a paper read by Mr. E. V. Evans, F.I.C., F.C.S., the Chief Chemist to the South Metropolitan Gas Company, before the London Section of the Society of Chemical Industry, on "The Removal of Carbon Bisulphide from Coal Gas," with a report of the discussion upon it. The subject, it will be remembered, was dealt with by Mr. Charles Carpenter, D.Sc., M.Inst.C.E., the Chairman of the Company, in a paper read at the meeting of the Société Technique du Gaz en France at Toulouse in 1913, and also in a lecture delivered before the Institution of Gas Engineers in Liverpool last June. The full text of Mr. Evans's paper, followed by a report of the discussion, is contained in the number of the Society's "Journal" for the 15th inst.; and though its salient features were indicated in the abstract which has already appeared, it will, we think, be useful to place on record the entire contribution. At its close the author acknowledged that throughout his research advice and encouragement had been continuously given to him by Mr. Carpenter, but for whose guidance the investigation would not, he said, have attained a successful issue.

Introductory.

The numerous chemical and physical processes that have from time to time been proposed for the removal of carbon bisulphide from coal gas are briefly described by Witzeck,* while the history of the subject, with special reference to processes involving the heating of gas, has been compiled by Mr. Charles Carpenter, D.Sc., and is included in his lecture delivered recently to the Institution of Gas Engineers at Liverpool.†

The sulphur compounds remaining in coal gas after the extraction of sulphuretted hydrogen consist mainly of carbon bisulphide; and the proportion by volume of this constituent in the gas represents only about 0·02 per cent. Considering the immense volumes of gas to be dealt with in the case of a modern London gas-works, it is obvious that the elimination of this impurity, owing to its state of extreme dilution, should be effected by a chemical reaction of high velocity. The initial stages of a laboratory investigation were therefore directed towards ascertaining the relative intensities of known reactions of carbon bisulphide, provided such reactions entailed the use of reagents suitable for application on the large scale. These may be collectively described under three headings:

1.—The extraction of carbon bisulphide by alkalis or alkaline earths, in the presence of sulphuretted hydrogen.
2.—The interaction of carbon bisulphide and certain amido compounds, such as aniline, either with or without the use of catalytic agents.
3.—The decomposition of carbon bisulphide by heat, with or without the presence of catalysts.

The "Athion" process, which utilizes alkaline cellulose for the extraction of carbon bisulphide from gas previously freed from carbon dioxide, is of recent origin, and was not examined by the author.

Alkalis and Alkaline Earths.

The purification of gas by lime is based on the absorption of carbon bisulphide by an active sulphided compound, with the formation of a thiocarbonate. As thiocarbonates are readily decomposed by carbon dioxide, the extraction of this constituent of the gas is essential. Carbon dioxide, though inevitably produced in the manufacture of gas, is not an impurity, and the necessity of removing it is an impediment to the economic efficiency of any process. When lime is employed to remove carbon dioxide, the cost of raw material alone represents about ½d. per 1000 cubic feet of gas purified, which is more than the total working costs of a process to be described later. It has been stated by Sabatier and others that the major portion of carbon dioxide may be extracted by washing the gas with solutions of potassium carbonate—the resulting bicarbonate being decomposed by heat with regeneration of the carbonate. This reaction is a slow one, and its application on a large scale necessitates the employment of extensive apparatus. It has, further, been proposed to recover for sale the carbon dioxide evolved in the regeneration process; but this obviously cannot receive wide application, as the output of a few large works would crush the market.

The nature of the reactions involved in the lime process of gas purification has been demonstrated by Divers and Veley; and the work of these investigators was repeated in the laboratory. Slaked lime yields, by the action of gas containing sulphuretted hydrogen, a sulphided compound capable of arresting carbon bisulphide, with the formation of a basic calcium thiocarbonate. The intermediate and final products of this reaction were prepared, and all laboratory operations demonstrated the extreme sensitiveness of the reaction to outside influences. A portion of the intermediate sulphided compound (considered by Divers to be calcium hydroxyhydrosulphide) became oxidized and rendered inactive by oxygen contained in small quantity in the gas; while the final product—the basic thiocarbonate—was not only decomposed by carbon dioxide, but was dissociated at slightly increased temperatures. Taking advantage of this instability to the influence of heat, an unsuccessful attempt was made to place the lime process on a more practical basis, by rendering possible the regeneration of spent material *in situ*, and thus overcoming the nuisance associated with spent lime. This scheme proved satisfactory only when utilizing pure reagents, and failed completely, when applied to the coal gas mixture, owing to the oxidation of active sulphides to sulphites and thiosulphates, which preclude regeneration, and to the difficulty of determining the conditions most favourable to the extraction of carbon bisulphide, and of completely eliminating the last trace of carbon dioxide from the gas.

The purification of large volumes of gas by a solid is objectionable, unless the reaction involved is of high chemical velocity, and such is not the case in the extraction of carbon bisulphide by lime. Finally, the process as generally adopted entails an enormous loss of sulphuretted hydrogen, which should be worked up into a marketable product.

The use of concentrated ammonia solution for removing carbon bisulphide as a thiocarbonate was found to be technically impracticable; while no advantage could be taken of the reaction—

$$CS_2 + 4NH_3 = NH_4SCN + (NH_4)_2S.$$

Amido Compounds.

Amido compounds of the type of aniline, toluidine, &c., have been employed; solid thioureas or thiocarbanilides being produced by the action of carbon bisulphide, thus—

$$2C_6H_5NH_2 + CS_2 = (C_6H_5NH)_2CS + H_2S.$$

The presence of sulphur or oxide of iron as catalyst has been recommended. This reaction presented considerable interest, as thiocarbanilide forms the starting-point in the manufacture of indigo by Sandmeyer's reaction; and it was demonstrated, after an extended study, that this process becomes a financial possibility with such an inexpensive raw material. A potent difficulty, however, existed in the loss of the amido compounds by volatilization; and the cost of preventing this, by further washing the gas with weak acids or with special oils, and of subsequently regenerating the reagent, was considered to be prohibitive.

Decomposition of Carbon Bisulphide by Heat.

It is well known that if coal gas be heated to about 500° C., most of the sulphur compounds are converted to sulphuretted hydrogen, which may be quite easily removed by oxide of iron. Mr. Vernon Harcourt, whose name stands foremost among all investigators of this question, has frequently recommended the application of this reaction on the large scale.

Preliminary work in the laboratory led to the conclusion that, of all known reactions of carbon bisulphide, its decomposition by heat in the presence of coal gas possessed the greatest possibilities of technical application; and in 1908 the investigation was directed entirely to this aspect of the question.

Carbon bisulphide is not dissociated into its elements to any appreciable extent by conducting it, in the presence of nitrogen, over contact material heated to 500° C. If, however, hydrogen or coal gas containing hydrogen be used as the gaseous carrier, the velocity of decomposition of the carbon bisulphide is greatly accelerated. Under these conditions, moreover, the decomposition of carbon bisulphide is complete, and the reaction is not a reversible one.

An experiment was performed in which purified carbon bisulphide was volatilized into a stream of pure hydrogen, at such a rate that the proportion by volume of carbon bisulphide was similar to that existing in coal gas. The gases were passed over heated fire-clay, which had been previously pulverized and freed from metallic impurities and carbonaceous matter. The rate of flow of the gaseous mixture was so adjusted that the carbon bisulphide was completely decomposed. The quantity of sulphuretted hydrogen evolved was determined, while the carbon deposited on the material was computed from the weight of carbon dioxide evolved on combustion. By this means it was proved that decomposition proceeds according to the equation—

$$CS_2 + 2H_2 = 2H_2S + C.$$

To determine the effect of water vapour on the reaction, carbon bisulphide was volatilized into a stream of moist hydrogen. The reaction again proceeded according to the above equation; the quantity of carbon deposited being in molecular proportion to the amount of carbon bisulphide decomposed. Further, carbon dioxide was not present in the final gas mixture. Thus the reaction

$$CS_2 + 2H_2O = 2H_2S + CO_2$$

does not take place under these conditions. It was later shown

* See "Journal für Gasbeleuchtung," 1903, p. 21.
† See "Journal," Vol. CXXVI., p. 928.

that the presence of water vapour does not increase the ease of decomposition of carbon bisulphide at a temperature of 450° C.

Coal gas, freed from sulphuretted hydrogen, was passed over various heated metals reduced to a state of fine division, in order to present a maximum surface area to the gas. Certain metals considerably increased the velocity of decomposition. This property was not a function of the specific heat or conductivity, or of the ease of formation of the sulphide of the metal. Porosity, on the other hand, was found to exert a beneficial effect; but this property in all bodies was rapidly destroyed owing to the deposition of carbon in the pores of the material. Platinum and palladium deposited on pumice, finely divided metals, such as iron, nickel, cobalt, and copper, were regarded as catalysts to the reaction; while magnesium and aluminium were not superior to contact substances of the type of alumina, pumice, and fire-clay. All these bodies, however, became coated with a deposit of finely divided carbon, which could be removed by combustion *in situ*.

Of all metals examined, iron was found to be most active, compatible with low original cost. The significant effect of temperature on the reaction was ascertained; and it was made evident that with the same catalyst, a low temperature and large surface of contact, as well as a high temperature and relatively small contact, were both capable of bringing about the required decomposition of carbon bisulphide. It appeared necessary, for the purpose of reducing to a minimum the size of the plant, that the highest temperature that could be suitably maintained on a large scale should be chosen, provided that the illuminating and calorific values of the gas were not altered, and that iron pipes and containers for the catalyst could be conveniently used. From a large number of determinations, it was proved that the intrinsic quality of the gas is in no way impaired when operating at temperatures between 450° and 500° C.; while to establish the second condition —which is indispensable to the technical success of the process— strips of wrought iron were surrounded by waste furnace gas for several weeks at a temperature of 450° C. No destructive effect was visible, and the gain in weight was negligible.

Having selected the working temperature, the amount of contact required to effect the maximum decomposition of carbon bisulphide was determined. At a temperature not exceeding 450° C., continuous laboratory experiments were made, using iron turnings as the catalyst, and purifying gas at the rate of 10 cubic feet per hour. By this means 75 to 80 per cent. of the sulphur compounds of gas could be removed. The whole of the carbon bisulphide had disappeared, and the residue, representing 7 to 9 grains of sulphur per 100 cubic feet of gas, consisted mainly of thiophen. From the experimental data obtained in the laboratory, a cast-iron retort was erected at a small works of the South Metropolitan Gas Company to deal with 50,000 cubic feet per hour.* Here the greatest mistake was made. The leap from 10 to 50,000 cubic feet per hour was disastrous. Though the surface of contact between the gas and iron had been proportionately reproduced from the laboratory scale, and a tubular heat interchanger had been installed to recover waste heat from the treated gas, the cooling effect of this large volume of gas upon the catalyst was such that, even when maintaining the retort externally at a low red heat, practially no reduction of sulphur compounds was accomplished.

In transferring laboratory conditions to the large scale in the case of reactions involving considerable expenditure of heat, there is a liability to overlook the fact that the laboratory furnace is usually out of all proportion to that which may be economically reproduced on the large scale.

The most valuable experience gained with this apparatus was when attempting to aërate the apparently spent material. This operation was found to be quite unmanageable on the large scale; and not only was the catalytic material fused, but a hole was made in the side of the retort where the chemical action of revivification by combustion was most intense. Laboratory experiments confirmed the difficulty of aërating without danger; and the idea of employing a metal catalyst, as such, was abandoned.

It was, therefore, proposed to impregnate a porous body with the catalyst, as, during the aëration, the particles undergoing change would be divided, and intense local chemical action would be prevented. Other investigators have recommended the use of porous impregnated material; but it is not recorded that this device has been adopted as a means of rendering manageable the aëration process.

It was expected that impregnated material would require more intimate contact with the gas than metallic substances; but in the case of iron oxide deposited on a porous nucleus, so large was the contact required as to necessitate the search for a more active catalyst. The object of an investigation into a large number of contact and catalytic substances was to choose the material that would require the lowest temperature for the reaction, that would remain active as long as possible, and when requiring aëration should allow of this being easily effected. Necessarily, in examining all these properties, the initial cost of the material was taken into consideration. The most active of all catalysts was found to be highly porous fire-clay, impregnated with nickel reduced from the chloride. From this work also it was made evident that the higher the temperature employed the greater is the quantity of carbon deposited on the material, and the more frequent becomes the necessity for aëration.

There is a tendency to decomposing unsaturated hydrocarbons of the gas; but the quantity decomposed, even at 600° C., is insufficient to exert a definite reduction in the quality of the gas. The inconvenience caused by the deposition of carbon on the catalyst presents a greater difficulty; and, in order to obviate this, it becomes imperative to reproduce the reaction at the minimum working temperature.

It will serve no useful purpose to describe several further unsuccessful attempts to reproduce the laboratory conditions and results on a large scale. The determination, either by experiment or calculation, of the following salient points led to the design of a system of pipes in which the reaction was successfully reproduced*:—

1.—The degree of preheating the gas before contact with the catalytic material. The temperature of the gas should be raised to that of the reaction before coming in contact with the catalyst. By this means only is the full value of the catalyst realized. With inefficient preheating the catalyst is cooled by the gas, and former experience shows that, in order to bring about the required chemical action, the investigator is tempted to increase the degree of heat around the container of the catalyst, with disastrous results to the iron vessel.

2.—The surface area of catalytic material exposed per unit volume of gas passed.

3.—The porosity, specific heat, and thermal conductivity of the porous carrier of the catalyst.

4.—The volume of free space allowed between the contact surfaces, which determines the absolute velocity of the gas molecules about the catalytic material.

5.—The surface area of the reaction and preheating vessels exposed to the heat of the furnace, together with the thickness and thermal conductivity of the material of which the vessels are made.

The system of tubes referred to consists of one 6-inch reaction tube containing the catalyst, and so many preheating tubes of 2 inches diameter as to bring the temperature of the untreated gas to within 50° C. of the reaction temperature. This apparatus was capable of dealing with 2000 cubic feet of gas hourly, and formed the basis of design of two large-scale plants—one erected in 1911 to deal with 2 million cubic feet of gas per day, and one in 1913 to deal with 10 millions. The latter installation has been in constant operation for almost two years, yielding an average reduction of 80 per cent. of the sulphur compounds of the gas treated therein.

The general principle of this apparatus† is as follows: Four 6-inch diameter reaction tubes are connected together in parallel, and are supplied by gas previously conducted through horizontal 2-inch preheating tubes erected at the back end of the heating chamber. Each set is capable of dealing with about 5000 cubic feet of gas hourly, and thus sixteen sets placed within a furnace constitute a plant capable of purifying 2 million cubic feet of gas per day.

The characteristics of gas before and after treatment by this process are shown in the following table:—

—	Before Treatment.	After Treatment.
Illuminating power . . . . . candles	14·7	14 7
Calorific power . . . . gross B.Th.U.	590·0	594·4
Sulphur . . . . grains per 100 cub. ft.	35·07	7·82
Naphthalene . . . " " " " "	5·54	4·71
Hydrocyanic acid . " " " " "	22·19	18·75
Analysis—		
CO_2 per cent. by volume	1·44	1·45
C_nH_m " "	3·55	3·63
O_2 " "	0·33	0·06
CO " "	8·16	8·03
CH_4 " "	26·85	27·26
H_2 " "	54·19	54·25
N_2 (by difference)	5·48	5·32

Ammonia is to be detected in gas leaving the plant, and arises from the hydrolysis of hydrocyanic acid. Although the quantity of ammonia evolved is too small to represent a financial asset, it serves a useful purpose in maintaining strongly alkaline the iron oxide used to remove the sulphuretted hydrogen formed by the decomposition of carbon bisulphide. Practically the whole of the oxygen contained in the gas is removed by this process, but the volume of gas before and after treatment remains unaltered.

There is a tendency to a slight increase in the methane content of the gas; but the process should not be compared with the more delicate one of the synthesis of methane by reduced nickel, which requires considerably more contact, and is influenced by "poisons," the most pernicious of which is sulphur. The decomposition of carbon bisulphide by heat in the presence of hydrogen is a simple reaction which takes place normally by passing the gases over a heated contact substance. The temperature required for decomposition is, however, lowered by the presence of a catalyst (and notably by reduced nickel) which allows the reaction to be performed in closed iron vessels.

The catalytic material of the sulphur process consists of a mixture of reduced nickel with a small quantity of nickel sulphide;

* The retort is shown in fig. 2 on p. 933 of the "JOURNAL" for June 23 last.

* See fig. 4 on p. 933 of the issue of the "JOURNAL" already cited.

† See fig. 6 on p. 934.

the quantity of the latter, at a constant temperature, being a function of the relative proportion of sulphuretted hydrogen and hydrogen existing in the gas at the moment of arresting the reaction.

The presence of sulphuretted hydrogen in the gas before treatment decreases the efficiency of the process, which cannot, therefore, be advantageously applied to crude gas. It would appear that carbon oxysulphide is produced by conducting gas containing carbon monoxide and sulphuretted hydrogen over the heated catalyst.

In the laboratory the following reactions have been found to take place under conditions similar to those existing on the large scale :—

$$H_2S \rightleftarrows H_2 + S \qquad CO + S \rightleftarrows COS.$$

Both reactions are reversible, and the formation of carbon oxysulphide only becomes appreciable when the quantity of sulphuretted hydrogen in the gas exceeds 100 grains per 100 cubic feet. Carbon oxysulphide is decomposed by water according to the following equation—

$$COS + H_2O = CO_2 + H_2S.$$

But this reaction is a slow one; and the removal of this sulphur compound from the gas is difficult.

The question of the possibility of forming nickel carbonyl in this process has received careful consideration. Numerous qualitative tests have been applied to the treated gas; but all attempts to detect nickel have failed. Nickel carbonyl is not produced even when the working temperature is reduced to 250° C.; but the precaution is taken to prohibit the contact of gas and the catalyst at temperatures below 300° C.

In the early part of 1914, a large installation capable of dealing with 15 million cubic feet of gas per day was put to work at East Greenwich. The design embodied an improvement which originated by observing the distribution of heat in an earlier installation, and aimed at reducing the initial cost of the plant. In this plant the 2-inch preheating pipes have been effectually replaced by tubular heat-interchangers erected outside the furnace setting. The East Greenwich plant is divided into five 3-million units.* Each unit consists of a central producer surmounted by a combustion chamber, situated on both sides of which are heating chambers, maintained at from 420° to 440° C. and in which are assembled the 6-inch reaction tubes. The gas is preheated to a small extent within the heating chamber, but mainly by tubular heat-interchangers, in which the treated gas flows in an opposite direction to that requiring treatment. In order to revivify the material of any one unit, the chamber temperature is lowered, and air is pumped at a definite rate through the reaction tubes. The process occupies about one week; and for the first four days the whole of the oxygen of the air is utilized and replaced by carbon dioxide. When oxygen appears in the effluent gas, the temperature of the chamber is raised to 430° C., and is maintained thus until carbon dioxide ceases to be evolved and the process is complete. When preparing for aëration, or restarting after aëration, gas or air, as the case may be, is displaced from the plant by inert waste furnace gases. The catalyst maintains its activity for about 30 to 35 days, after which period the efficiency of the reaction gradually decreases. Its original activity is, however, immediately restored by the process of aëration. After having been in operation for two years, the catalytic material shows no signs of deterioration.

The capital outlay for plant is £1500 per million cubic feet of gas per day, while the working costs entailed in operating the process represent 0·3d. per 1000 cubic feet of gas; the latter figure including interest on capital, depreciation, and repair and maintenance.

* The arrangement of the plant referred to was illustrated on p. 935 of the "JOURNAL" for June 23 last.

Gas Light and Coke Company's Dividend.

The Secretary of the Gas Light and Coke Company (Mr. Henry Rayner) notifies us that the accounts of the Company for the past half year show that (subject to audit) the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 13s. 4d. per cent. per annum, carrying forward £384,538 3s. 10d. to the next account. The balance brought into the accounts was £535,314 1s. 4d. A year ago the dividend was at the rate of £4 17s. 4d. per cent. per annum, and the carry-forward £614,052 16s. 5d.

School Lighting.—The American Illuminating Engineering Society have organized a Committee on School Lighting, under the Chairmanship of Mr. M. Luckiesh, of Cleveland (Ohio). The following are briefly the objects of the Committee: To prepare a lecture dealing with the conservation of the eyesight of school children, to be delivered before school authorities, and to include the fundamental principles underlying good and bad natural and artificial lighting; to report on lighting conditions in schools; to prepare plans and specifications of model class-rooms; to introduce brief courses in lighting as a part of the home-making and practical physics courses; to construct a miniature model classroom for exhibition; to prepare a code on school lighting, suitable for legislative guidance; and to give general publicity to the importance of good lighting as concerning vision.

COKE.

By VIVIAN B. LEWES, F.I.C., F.C.S.

[A Lecture to the London and Southern District Junior Gas Association, Jan. 22.]

From time to time there arise periods so fraught with importance to the years succeeding them that they form eras in the world's history; and few will doubt but that this year of 1915 will stand out as marking the advent of a new order of things in the struggle for commercial supremacy between the countries of the Old World.

It is at moments such as these that it behoves every country to stir itself and put its industries on the best possible footing; and upon its preparedness to do this, and upon its clearness of vision as to the best way to do it, depend its prospects of success.

Every English industry should at the present moment be debating and discussing the position in which it will find itself when at length military despotism has for the time being been crushed, and the prospect of a century of peace heartens the world to strive for commercial prosperity and advance.

COAL ABUNDANCE AND EXTRAVAGANCE.

Among the factors that lead to the commercial supremacy of a country, by far the most important is the command of fuel or other source of power; and England's position in the past has been governed largely by her coalfields, which in little more than a century raised her to the forefront as a commercial power. The very abundance of our coal supplies was a source of weakness, as it led to outrageous waste, polluted our atmosphere to a criminal extent, and so encouraged uneconomical methods of using it as seriously to deplete our available stock, the result of which has been the increase in price during the last few years, and the certainty that the future will see further advances but no fall to the old rates. The day of cheap coal has gone, never to return.

To the gas industry this means that unless a reconsideration of the position leads to the adoption of new methods, and drags the industry out of the ruts in which it has crystallized, there is nothing to look forward to in the way of cheapening gas, and that as the recognition of the hygienic value of coal gas as a heating and lighting agent has set the seal on the popularity it has gained from its convenience and cleanliness, increase in price will become imperative, and seriously check its advance for fuel purposes.

IMPROVED METHODS OF CARBONIZATION.

During the past ten years the industry has done everything it could to advance the sale of gas and to popularize it; while for the last fifty years the works' managers and engineers have, with the aid of more refractory material for retorts and regenerative furnaces, pressed the temperature of carbonization to the highest point they could attain, in order to squeeze out of the coal every foot of gas that could be obtained. With the passing of the iron retort that had held its own from the days of Murdoch up to sixty years ago, the fire-clay retort that had usurped it gave the possibility of using a higher temperature in carbonization, and brought the old average yield of 9000 cubic feet per ton of coal up to 10,000 cubic feet. Regeneration then came to the gas manager's aid; and the average rose to 11,000, and finally to 12,000 cubic feet per ton.

These advances were made with horizontals and light charges, with the result that the tar sank in quantity to 8 or 9 gallons of poor quality, so laden with soot and naphthalene as to be nearly valueless; while the coke became as difficult to ignite as metallurgical coke, and so gave a dull fire unfitted for house work. Its high sulphur and ash also rendered it unsuitable for metallurgical work. At this crisis, when the gas manager seemed within easy reach of murdering the gas industry by ruining his bye-products in his insane desire to increase the yield of gas, the vertical retort and full charges came to the relief of the situation and, by rendering it impossible for him to overheat the gas and tar vapours from the first portion carbonized, improved the quality of both gas and tar, while the complete degradation of the gas and tar during the later stages of the carbonization kept up the gas volume, and even raised it. The coke also was improved slightly, as the core of the charge leavened the exterior portions with enough soft coke to render it usable.

This, roughly, is the condition of manufacture that exists today. No industry likes to be told that any meed of its success has been due to anything but its own endeavour; but when one considers how the statutory lowering of the candle power, the introduction of the No. 2 argand standard burner, and finally the substitution of a calorific standard for an illuminating one have aided the gas companies in their endeavour to obtain the maximum yield of gas per ton of coal, it must be admitted that the way has been made easy.

GAS-WORKS AND SMOKELESS FUEL.

The advance in the use of coal gas as fuel in cookers and gas-stoves has been phenomenal; and the replacement of one-sixth of the coal-burning grates by gas-stoves in London has given convincing proof of what may be done in cleansing the atmosphere by the use of smokeless fuel. It has always been my firm conviction that the Utopian dreams of the smoke reformer will be reached by the abandonment of the use of bituminous coal as fuel in favour of gas and coke—that, in fact, the gas-works of the

country should be the road of entry for all domestic fuel, thus purging it from the smoke-forming tar that has cost the country millions of pounds in money and millions of tons in coal.

It must be clear to everyone that as the carbonization of coal gives as products gas, coke, tar, and ammoniacal liquor, no one product can be pushed economically into favour unless the markets for the other products be increased *pro rata*, and the possibilities of doing this successfully have, to my mind at least, so great an economic bearing on the question of gas manufacture as to lead me to hope that in the future the gas industry will be enabled not only to fulfil its allotted task of supplying cheap heating and lighting gas to the community, but also the Imperial ones of conserving our coal supplies and cleansing our town air.

The Future of Coke.

In choosing the title of "coke" for my talk with you to-night, I am influenced by the fact that in the future this somewhat despised product of gas manufacture will play, if I am not mistaken, as important a part as the gas itself in solving the problem that must always be before the gas manager of—given a ton of coal—how to supply most profitably the market with the products it requires.

Six months ago every spare space in our Metropolitan gas-works was piled with surplus coke, which had accumulated largely because the serious rise in the price of gas-oil had led to many of the carburetted water-gas plants standing idle. The coke market was, therefore, overstocked. To-day not only have all accumulations vanished, but the supply is scarcely sufficient to meet the demand. The cause of this reversal in conditions is that our command of the sea, lower freights, and reduced markets have brought the price of gas-oil down once more; while temporary difficulties in transport have shortened the supply of coal, with the result that the carburetted water-gas plants have been unusually busy, and have taken more than their share of the reduced production.

Both these conditions of the coke market are abnormal; and to-night I want to review the methods which in the peaceful future we shall probably have to consider in order to make the public demand for gas coke keep pace with the larger production that must follow from the increasing consumption of coal gas for fuel purposes.

Considering the teaching of the last few months, it might well be argued that the carburetted water-gas plant provides an answer to the whole question; that it is a governing factor so delicate that the supply of coke can be made to a nicety to suit the market; and that if the demand for gas rose to a point at which the coke made exceeded the demand, carburetted water gas at the present price of gas oil can be made as cheaply as coal gas, so that no surplus coke need hamper the market.

The fallacy in this argument lies in supposing that, in the future, the price of oil will remain at the low ebb to which a combination of events that never can occur again has brought it. The reason for the recent fall in price is to be found in the fact that the enormous increase in the demand for petrol during the last ten years—caused by the rapid advances that have taken place in motor cars, motor traction, and aëroplanes—led to such an increase in freights in 1912 that the price of gas-oil rose in this country while enormous stocks accumulated at the wells and refining centres. This, in turn, led to whole fleets of oil tank-steamers being launched, with the result that freights have fallen for American gas oil to a point which enables contracts to be made at the present low rates. There is no doubt that oil will continue at the present low price so long as there are surplus stocks and tank-steamers awaiting freights. But the gas companies long ago have learnt the lesson of not adopting methods of manufacture that leave them at the mercy of such powerful combinations as govern the oil market; while oil, like coal, is undergoing gradual depletion (and probably at a much faster rate), so that, however skilful may be the manipulation of the market, prices are bound to rise.

The only firm basis on which to found any arguments for future advance must be on the treatment of the coal itself, as the price of the fuel products of its distillation will always bear a relation to the market price of coal, and so tend to balance initial cost. The more therefore the profit-earning power of the coke and tar can be increased, the better will be the chance of lowering the price of gas, or at any rate keeping it at existing prices.

Coke as a Bye-Product and a Chief Product.

In approaching the subject of coke, the first thing to bear clearly in mind is that its qualities and properties are dependent entirely on the method and temperature employed in its manufacture, and that its composition will vary with these factors as widely as its physical properties. As a result, we find coke classified under two heads—"gas coke," which is merely a bye-product of the gas-works, and "metallurgical coke," which is the chief product of the coke-oven plant.

In the manufacture of both, the same class of coal is employed; and in each case it is distilled at much the same temperature. But in making the oven coke for metallurgical work, every care is lavished on obtaining strength and purity in the solid product; and next to it in importance come the ammonium sulphate and benzol that can be recovered. The gas manager, on the other hand, gives all his attention to the make of gas, and devotes but little thought to the coke as long as it is sufficiently saleable to keep the yard clear. We have seen the extraordinary fluctuations in gas coke supply brought about during the past year by fluctuations in the oil market; and during this period the coke-oven manager has been experiencing even more trying times. Owing to the extra demand for benzol created by its use as a substitute for petrol, the last few years have seen great activity in the conversion of beehive ovens into recovery oven plant; and the output of coke has been from 10 to 11 million tons per annum. Depression in the iron trade, however, has reduced the demand for oven-coke to an extent that has overstocked the market to an even greater degree than had befallen the gas-coke market in the middle of last year; and many coking plants are unable to work at a profit. The demand for iron and steel created by the war, which will probably increase for structural work after the war is over, should improve these conditions.

Under modern conditions of gas manufacture, the whole tendency of the last sixty years has been a pressing of temperatures in coal carbonization, in order to obtain the largest volume of gas; while in coke-oven practice again the same or higher temperatures have been employed to get metallurgical coke sufficiently hard to withstand not only the weight of the charge in the blast-furnace, but also the attrition as the charge moves down the column.

In the latter case the temperatures employed have been justified by the fact that it is the only way to obtain the necessary strength; but in gas practice I venture to think that the so-called advances of the last half-century have been a grave mistake. The gas industry has been so obsessed with the idea that gas volume was the thing to aim at that the fundamental axiom has been forgotten—namely, that what is wanted is the greatest value from a ton of coal.

In coal, Nature has given the world a limited store of compounds pre-eminent in their power of energy production—a store formed under conditions that never can be reproduced with present atmospheric conditions; a store of incalculable value which we, like the spendthrifts who inherit a fortune from a hard-working sire, are squandering with an open hand.

The agglomerate of vegetable remains, and the resinous body which we call coal lends itself to destructive distillation at all temperatures above 450° C. But the course which this distillation takes, and the products we obtain from it, differ in quantity and kind with every few degrees that the temperature rises.

At low and medium temperatures, one obtains the hydrocarbons (gaseous and as vapours) in the greatest abundance—hydrocarbons which can be obtained from other sources only by laborious and costly processes. Raise the temperature, and these bodies undergo transformation by the heat into other hydrocarbons. Press the temperatures to the highest obtainable, and the hydrocarbons are degraded and broken-down into hydrogen and solid carbon that crusts the retort, and soot that loads and ruins the tar. The volume of the gas increases by something like 1000 cubic feet per ton of coal carbonized for every 100° C. increase of temperature; but the hydrocarbons grow more scanty in quantity, and simpler in composition. Both the thermal and illuminating value suffer; and if furnace material could be obtained that would stand the temperature, and complete decomposition could be secured, the products would be coke as hard as oven-coke, no tar, and about 27,000 cubic feet of a non-luminous gas, with a thermal value of 300 B.Th.U., and of no more value than blue water gas, but costing twice as much to make—truly a great goal for an important industry to be striving for!

A large amount of work has been done by many observers on the results obtained by carbonizing coal at various temperatures; and for a good gas coal we can closely prognosticate the results to be obtained at any particular temperature. But before attempting to apply this knowledge let us be sure we are clear in our mind as to the exact character of the products we desire to obtain, and that the market they will command is the widest and most remunerative.

1.—Gas.

The yield of gas must be as high in volume as can be obtained by the excessive heats now in vogue, and must comply with the statutory requirements—that is, it must have a thermal value of 540 B.Th.U., with an outside lower limit of 500 B.Th.U., and an illuminating value of 14 candles, as although the Gas Light and Coke Company have freed themselves from the yoke of an illuminating penalty standard, and other companies will soon follow their lead, prudence counsels keeping to as near the old standard as possible in the interests of those who still consider the flat-flame essential in passages, cellars, &c.

2.—Coke.

This, as I have pointed out, will in the future be the salvation of the industry. But it will not be the hard, ash-laden, and with difficulty ignitable product of to-day, commanding a limited market as fuel among the poorer classes, in small works, and for horticultural purposes. Show me the works at which the gas made per ton averages over 12,000 cubic feet, and I will show you a district where coke has only a low sale. The two great drawbacks to coke as a domestic fuel are that the housewife jibs at the amount of ash, which adds to the dust in the house; and, secondly, that in nine out of every ten grates it burns with a dull red glow, and no traces of a flicker, while the absence of flame so lowers the chimney draught that a gust of wind outside flavours the air of the room with a sulphur taint.

The first of these troubles is due to want of care in selecting the coal. There is no need to take coals with the high ash that is often found. Remember that the ash of the coal concentrates in

the coke left behind on carbonization; so that, from a coal with 5 per cent. of ash, 7 or 8 per cent. will be obtained in the coke.

The second trouble is due to the whole of the volatile matter having been driven out of the coke, which raises its ignition point, and so gives difficulty in lighting the fire, and prevents the combustion spreading freely unless there is an exceptionally strong draught in the chimney. If 4 or 5 per cent. of volatile matter is left in the coke, the difference it makes in the way the coke burns is incredible (it converts a bad domestic fuel into a good one); while if 10 per cent. is left in, an ideal fuel is produced, as one obtains not only easy ignition but a blue flickering flame that helps the chimney draught, and a bright hot fire. The practical trouble of leaving 10 per cent. of volatile matter in the coke is, however, that the coal has to be carbonized at 500° to 600° C.; and if this is done by any ordinary process, the semi-coke is so soft and tender that the losses in smalls become excessive. Leaving 4 or 5 per cent., however, gives practically the same kind of coke as was obtained before regeneration came to the aid of high temperatures; and to-day I would rather give 25s. a ton for the coke from a small country works than 18s. for the product of our big gas-works. A better object-lesson could not be obtained than is to be found in Mr. Vernon Harcourt's new coke-stove, which can be seen in the Horseferry Road Show-Rooms. There, fed with the most tender care, it will as often go out as give a decent fire; but try it with country coke made at a rational temperature, and containing 4 or 5 per cent. of volatile matter, and one has a perfect fire of wonderful heat-radiating value.

Remember that if one has coke that will burn bright, its radiant heating value is more than twice that of bituminous coal, because although the bituminous coal may contain 14,000 B.Th.U. per pound, and the coke only 13,000 B.Th.U. per pound, yet in the coal-fire only about 25 per cent. is utilized as radiant heat, while in the coke-fire the efficiency is nearer 50 per cent. The curse of bituminous coal as a fuel is that it destructively distils below its own temperature of ignition; and the tar vapour and gases escaping up the chimney from a newly-fed fire are not only a heavy fuel loss but a criminal pollution of the air, which should no more be allowed than the poisoning of a drinking water supply.

The attitude of many gas managers towards any suggested attempts at improving the quality of their coke is generally met by the remark that if they did improve its quality and leave a little more volatile matter in it, there would be no more demand for it than at present, and the gas make would be so much the smaller. This argument is all wrong. The domestic demand for a good free-burning coke is enormous; but the trouble is that it cannot be obtained. The market has been ruined by the quality the gas-works have sold for the past thirty years; but a year's work with a good quality coke would give a demand that could not be satisfied, and at a price only 2s. or 3s. below that of coal. Why does the gas manager always take it for granted that he cannot get more than 18s. or 20s. a ton for his coke? Simply because he will not take the trouble to specialize in coke to find out what the market wants and to supply it. The coke-oven manager has done this; and, by providing the class of coke wanted for metallurgical work, he commands a 50 per cent. higher price than can be obtained for gas coke.

With the gas manager, however, instead of studying his own market and catering for it, every change he makes in his coke brings him nearer to the hard coke field. He can never enter this field, because of the ash and sulphur in his coke; so why on earth cannot he "stake out a claim" of his own and capture the biggest market in the world—domestic fuel?

I hope I have said enough to emphasize the point that in our gas coke what we must aim at is a coke sufficiently strong to stand all commercial handling, low in ash, and rendered free-burning by leaving in it 4 to 5 per cent. of volatile matter.

3.—Tar.

Here we approach a subject of the greatest complexity. The composition of coal tar varies to so radical an extent with the temperature and conditions of carbonization that it is more important in the case of this bye-product to know what we desire it to contain, before fixing the conditions under which it is to be made, than with any of the others. If the coal is distilled at 500° to 600° C., the tar is large in quantity (20 to 24 gallons to the ton), of low specific gravity, and its composition is characterized by the chief groups of hydrocarbons being paraffins and naphthenes. While the aromatic series of hydrocarbons is low, naphthalene and free carbon are absent, and the pitch is of very fine quality. Such tar may be called "paraffinoid." As the temperature employed rises, the naphthenes shed off hydrogen, and become aromatic hydrocarbons, which reach their maximum production as regards the lower and most valuable members of the series when the temperature of distillation reaches 900° to 1000° C. The volume of tar is about 12 to 13 gallons; naphthalene is not excessive in quantity; and the pitch is good, and without any large amount of free carbon. Such tars we will call "benzenoid." Press the temperature of carbonization to 1200° C., and with light charges all the valuable constituents are decomposed, and 8 gallons of soot-laden tar, consisting chiefly of creosote oils, naphthalene, and pitch, are obtained, of the character that ruined the tar market ten years ago.

The question we have to decide is, Which will be of the most value at the present time and under the conditions that will exist at the end of the war—20 gallons of paraffinoid or 13 gallons of benzenoid tar? Under the conditions prevailing even a year ago, the larger volume would have been the most desirable; but at the present time the strong movement which is on foot, and which, in spite of a temporary set-back, will undoubtedly fructify, of a State-supported effort to win back the Tar Colour Industry filched from us by the Germans, makes hydrocarbons of the aromatic series of primary importance, while after these are separated the residual tar is better fitted for road-making than the low-temperature tar, which is very rich in cresylic acids. It is clear, therefore, that carbonization at from 900° to 1000° C. will pay best as regards the tar in these circumstances.

4.—Ammonia Recovery.

The average amount of nitrogen in coal is 1·4 per cent.; and if the whole of it could be converted into sulphate of ammonia we should obtain theoretically 147·8 lbs. per ton of coal carbonized. The nitrogen, however, is contained in the coal in several forms of combination—some of them so easily decomposed into ammonia that, when coal is distilled at the lowest practical temperature, 12 lbs. of sulphate can be recovered. Other nitrogen compounds are, however, so resistant that we find nitrogen still remaining in coke that has been heated for many hours to the highest temperatures employed. There is nitrogen also in the tar, and coming off as free nitrogen in the gas, with the result that under the best gas-works conditions only about 17 per cent. is recoverable as sulphate—*i.e.*, 25 lbs.

When coal is carbonized at the lowest practical temperature—*i.e.*, 450° to 500° C.—only 12 lbs. of ammonium sulphate are recovered per ton of coal; but the amount rises with the temperature, until at from 900° to 1000° C., the maximum is reached, and above 1000° C. a gradual falling off in quantity takes place, owing to the slow decomposition of ammonia gas in spite of the protecting influence of dilution, without which it would all be decomposed at 780° C. and no sulphate recovered.

It is clear from this that in the interests of sulphate of ammonia production, as well as for the coke and tar, 900° to 1000° C is the most economical temperature to employ for carbonization. But the trouble that at once presents itself to the manager's mind is that carbonization at this temperature yields only 10,000 feet of gas, and that it has a candle power of 16·5 on the "London" argand and 18·5 on the No. 2, with a thermal value of 680 B.Th.U., while he wants 13,000 cubic feet of 540 B.Th.U. gas.

Under modern high-temperature conditions of gas manufacture all gas over 10,000 cubic feet per ton is, as I have shown, of no more value than blue water gas, and costs at the present time three times as much, while if the last few per cents of volatile matter were left in the coke, their value in converting an inferior fuel into one that would command a universal market would be infinitely greater than as gas.

Moreover the shortage in gas can be readily made up by blue water gas, so as to obtain the full volume; and at the same time the advantages to the bye-products would be enormous. But once the volatile matter is driven out from the coke it cannot be replaced, and the gain in volume of gas is heavily discounted by degraded residuals.

A Suggestion to Gas Manufacturers.

Let us get an idea of the volume of water gas that could be added to coal gas made at 1000° C., in order to comply with the parliamentary standard of 540 B.Th.U.

Blue water gas has a gross thermal value of 320 B.Th.U., and a mixture of 5000 cubic feet with the 10,000 cubic feet of 680 B.Th.U. coal gas would give 15,000 cubic feet of mixture having a calorific value of 560 B.Th.U. That is to say, the gas manager would have 2000 cubic feet per ton more gas to distribute and more tar to sell per ton of coal carbonized, while the quality of the coke would have been enormously improved.

The way to carry out this suggestion would be to carbonize for eight hours with medium charges at a temperature of 1050° C. in the heating chambers, and pass the water gas hot from the generator into the foul main. The passage of the two gases together through the purifiers, &c., would ensure thorough admixture and also improve the illuminating power by taking up a trace more of the vapours of volatile hydrocarbons, so that the illuminating value of the mixture, instead of being two-thirds of 18·5 = 12·26, would be about 14 candles.

There is in my mind no doubt that considerable economies would result from such a process, as the wear and tear to plant of forcing temperatures is very great, while as the improved character of the coke and tar became recognized more substantial profits would ensue.

I submit this suggestion to you for your consideration, discussion, and, I hope, trial, as the connection from the water-gas plant to the foul main, and the slight drop of temperature in carbonization, cannot be considered as prohibitive.

There is nothing new about the idea, except lowering the temperature of carbonization. The passing of water gas into the hydraulic main I suggested sixteen years ago; and it proved very successful on the Continent, and in some small works where excessive temperatures were not used.

About the same time also I made a number of experiments at the South Suburban Gas-Works on passing water gas through the retorts during carbonization—a process taken up abroad and there christened with the grandiloquent title of "autocarburation." With a poor Derbyshire coal that was being used, and which gave when carbonized alone 9907 cubic feet of gas per ton of 608 B.Th.U.

and 16·5 candles illuminating power, I obtained by passing water gas through the retorts during carbonization 14,925 cubic feet of gas per ton, of 508·8 B.Th.U., with an illuminating power of 14·4 candles.

This was so promising that Mr. S. O. Stephenson tried the process at Tipton, also with satisfactory results; while Mr. Brown, who had started some experiments on the subject at Ilford, on being appointed to Nottingham made a series of experiments lasting over three years with various classes of coals. His paper —read before the Institution of Gas Engineers in 1905—holds, I think, the record for the maximum of figures given; but although he obtained some very good results and showed many advantages, the results were so erratic that the process was damned by a verdict of "not proven."

The whole secret of his failure to obtain concordant results was that with each class of coal he tuned his temperature up to the highest point he could get; carbonized the coal alone; and then at the same temperature carbonized with a flow of water gas. By this method of testing, two disturbing factors crept in. In the first case, the water gas, even if heated, was much below the temperature of the retort and so cooled the surface of the carbonizing mass to a degree which varied with the percentage of water gas taken, while with the high temperatures used, the heat in the mass of coke was so high as to ruin the gas passing through it before coming under the influence of the water gas.

As far as I know nothing further was ever tried with the process; but if any other experiments have been made I should be very interested to hear the results obtained, as now that the illuminating standard is disappearing, in favour of calorific value, we should give all the attention possible to increasing the volume of gas obtained—not by degradation, but by dilution.

In conclusion, let me once more reiterate my plea for more attention to the quality of the coke. The chances of making a large and remunerative market were never better than at the present time. Not only does the price of coal force attention to the claims of coke as a domestic fuel; but other fields hitherto untouched are rapidly opening up. The "National" coke-fuel motors, owing to Mr. Clarkson's new boiler, are demonstrating that, for the motor bus and commercial motor van, gas coke will do heavy work at less than half the price of petrol paid by the big motor bus companies; and as the greatest development in the motor industry during the next few years will be in commercial vehicles, the supply of a graded size of gas coke for this purpose opens up an enormous market. Then, again, engineers are beginning to realize that, for power stations and pumping works, gas coke gives higher efficiency and smaller clinker than bituminous coal; while the absence of smoke ought to make its use compulsory.

Add to these the coke used for making blue water gas as a diluent for coal gas, and it will be seen that no fear need be entertained as to the future of gas coke, and that it deserves as much attention from the gas manager as his chief product.

Vote of Thanks.—The Market for Coke.

The President (Mr. J. Hewett, of the South Metropolitan Gas Company) remarked that many of them had already had the pleasure of listening to Professor Lewes on more than one occasion, and knew that they were in for an instructive and enjoyable evening; while those who had not heard him before, knew now what a pleasure it was to be present at his lectures. Not only did he invariably tell his audience something worth hearing, but he put it to them in such a manner that the proceedings were by no means of the "dry-as-dust" order. Professor Lewes had given his lecture the title of "Coke;" but he (the speaker) was thinking while listening to it that, if a name were wanted, it might have been called a lecture on the "Sliding-Scale of Gas Manufacture." He had dealt with varying conditions of the gas industry, and pointed out that during the last few months, through circumstances which had arisen, and over which they really had no control, certain alterations had appeared to him to be necessary in methods of carbonization, and so forth. The necessity for obtaining large quantities of toluene had been made apparent; everyone was talking about it. He would ask Mr. Gill to propose a vote of thanks.

Mr. G. M. Gill (Commercial Gas Company) said he had listened with fascination to what Professor Lewes had been telling them; and he felt sorry for those who had not been able to be present at the lecture. There had been sketched out a very interesting proposition, and one to which all gas engineers should give close attention. But there were one or two points in Professor Lewes's suggestion with which some people, at any rate, would be inclined to disagree. There was no doubt about it that coke containing 4 to 5 per cent. of volatile matter would form an ideal fuel, especially for domestic purposes; but although during the last year or more coke had been in a rather bad way—as the lecturer had pointed out, there had been huge stocks all over the country—it was his (Mr. Gill's) opinion that, even if they went on with their present methods of manufacture, a market would be found for this coke as it was. A great deal had been accomplished in pushing coke for steam-raising purposes containing 1, 2, or perhaps even 3 per cent. of volatile matter; and he himself had done a lot of work in this direction in connection with his own Company. He had found, to his surprise, that coke as it was formed in heavy charges, with a make of gas rather higher than figures which had been quoted by Professor Lewes, was an excellent fuel for boilers; and it had shown itself on plenty of occasions to be practically as good as hard steam coal, costing in normal times something over £1 a ton delivered free in London. Engineers in charge of large boiler installations had told him that, greatly to their astonishment, a ton of coke had given practically as good a result as a ton of good hard steam coal. One engineer in a big public institution had shown him a copy of his report after he had run a test of broken coke; and he stated that it needed 11 tons of coke to give as good a result as 10 tons of hard steam coal, costing 21s. 6d. a ton. Another engineer in charge of a couple of large Lancashire boilers told him that in a three months' trial of broken coke, using it the whole of the time, it took 8 tons of coke to give as good a result as did 7 tons of Welsh coal, costing, perhaps, 7s., 8s., or 9s. a ton additional. It had also been shown on two or three occasions in different boiler installations that 6 tons of coke would give as good a result as about 8 tons of slack as generally used in London; and taking these facts into consideration, he must say he did not at all adopt a gloomy view of the prospects of coke, if only people would find their market. No more than a few large boiler installations were needed for an undertaking to dispose of all its surplus coke, and at very high prices. In addition to this, there was already, as Professor Lewes had pointed out, quite a good market in laundries and furnaces, and for a number of such purposes as small boilers for central heating. Therefore, it appeared to him that they ought to find a market for their coke, without the necessity of leaving in it from 4 to 5 per cent. of volatile matter. As regarded the domestic market, he might point out that the continuous vertical retorts were yielding a coke which, although it had not in it the percentage of volatile matter named, was quite good for domestic purposes. It would burn very freely, and was being used all over the place for consumption in open grates. Recently, there had been read a paper on pushing coke in Bradford, where it was practically all vertical retort coke; and it was shown that they had built up quite a large domestic business with it. The reason for this was, he thought, that they had pushed it in the correct way, and they also had the right article. This vertical retort coke was certainly softer than coke from heavy charges; and it was porous. The air could get to it, and it burned very much more freely. As had been pointed out, the coke as made at present was giving a very good result when used for omnibuses; so that no doubt, even though the gas undertakings might not change their method of carbonization, these omnibuses would use a lot of coke, and could offer a good price for it, too. As regarded the tar, Professor Lewes had stated that with a make of gas of 13,000 cubic feet per ton, they did not get a high yield of tar. He (the speaker) found they did,

Professor Lewes said he was referring to light charges.

Mr. Gill said that with heavy charges they could get well over 11 gallons of a tar, not at all bad in quality. It had a specific gravity of about 1·15, and gave not a high content of fixed carbon. At the same time, the suggestion of the lecturer that they should aim at a smaller make of gas per ton, a better coke, a better tar, and more ammonia, and add a percentage of blue water gas, was undoubtedly attractive; and a great many men to-day would be very interested to see the effect of such a policy in pounds, shillings, and pence. It was more than likely that it would show an excellent result. He had the greatest pleasure in proposing a hearty vote of thanks to Professor Lewes for his excellent and instructive lecture.

Mr. G. F. Cox (Commercial Gas Company), in seconding, said the remarks as to the advisability of striking a balance-sheet at the present time were very apt. In the future, the conditions would naturally be altered; and now was the time to take stock. Of course, they wanted to make as much out of a ton of coal as they possibly could; and they must not look entirely to the gas. It was on the residuals that they had largely to depend to help them to decrease the price of gas, and get it down to a figure that would enable them to compete for all purposes. With regard to the make of coke, and pushing its sale, and different matters that Mr. Gill had mentioned, he could bear out what he had said, as he had been fortunate enough to be associated with Mr. Gill in some of his propositions. As to tar, he would like to remark that it seemed to him this was a matter which would well repay consideration. In the past, tar had been left very much to look after itself; and more attention and care might be expended upon its production, especially under present conditions. It was some years since Professor Lewes had given them a lecture; and he hoped it would not be so long before he again came and gave them another.

The members having shown unmistakably by applause their appreciation of Professor Lewes's kindness in thus devoting an evening to them,

Professor Lewes said it was always a very great pleasure to meet them; and he hoped it might not be so long again before he could come and have another chat with the members. In the meantime, if any of them cared to go to the Society of Arts next month, when he would be giving three lectures on "Motor Fuels," he would be pleased to let them have tickets, if they would send their names in to the Secretary of the Association. These might not appear to be of much interest to them; but, after all was said and done, processes he would describe had many actions which were very closely akin to the actions one found going on in the conversion of one kind of tar to another.

At the Royal Institution, next Friday, Mr. Dugald Clerk, F.R.S., D.Sc., will deliver a lecture on "Gaseous Explosions."

USE OF GAS IN RAILWAY SHOPS.

At the New York Conference of the American Commercial Gas Association, a paper on "The Use of Gas in Railway Shops" was presented in the Industrial Section by Mr. E. C. Romine. It is reproduced below, practically in full, from the "Bulletin" of the Association for the current month.

Since a great many of the heating operations to which city gas can be applied are peformed in every railroad shop, each shop offers a large and varied field for the sale of industrial gas. The total amount of fuel used for these heating operations depends greatly upon the character of the work done in the particular shop under consideration. The question whether gas can compete with other fuels must be decided from each individual case after the comparative costs of fuels in the vicinity are known and local conditions are investigated.

The following figures will give a rough idea of the amount of fuel used in a fairly large shop in which 2000 men are employed, and where, on an average, 60 locomotives are repaired and rebuilt every month. The shop includes a steel coal car repair department where the cars are completely renovated. The fuels used throughout the shop in the various heating operations (other than power) consist of fuel oil, city gas, and coal. The oil consumption amounts to 50,000 gallons, the city gas to 350,000 cubic feet, the coal to 150 tons. In another large shop where 900 men are employed, the railroad company operate a blue water-gas plant, using this gas for all heating operations throughout the shops. Their generator fuel alone amounts to some 425 tons of anthracite coal per month. In proportion to its size, every other railroad shop is a correspondingly large user of fuel, and consequently the master mechanics are always interested in learning the possibilities of city gas.

It might be well to discuss the various heating operations performed in the average shop under the following headings.

Forging.

In a railroad forge shop all kinds of forging must be done, from the heating of ⅜-inch bars for the automatic bolt-heading machines to the heating of pieces 10 inches square and 8 feet long, which are forced under a 5000-lb. steam-hammer into the locomotive side-frames. In a great many shops the forging department uses oil for the smaller heating furnaces and soft coal for the larger ones. Some of the furnaces for heating blanks for making rivets and bolts are occasionally operated with city gas; but with the exception of this light work, it is not possible for city gas to compete with oil or coal for heating the forging furnace. Flue welding is sometimes done with city gas.

Riveting.

Every railroad shop does a certain amount of riveting, and where a company repair their own steel cars, a large amount of riveting must be done in this department. In one of the shops previously mentioned, 40 oil-fired rivet-heaters are in continuous use ten hours per day.

Many gas companies have recently devoted considerable time and money in endeavouring to secure rivet-heating business, and it will no doubt be advisable to discuss this work at considerable length. Such marked savings in labour and in final operating costs can be effected with city gas or fuel oil over coke or soft coal for heating rivet furnaces, that only the two former fuels should be considered as competitors for this work.

In reference to displacing oil by gas, a very important factor is the price at which the two fuels can be purchased. Assuming an average low selling price of 4 c. per gallon for oil and 70 c. per 1000 cubic feet for gas, the final costs are in favour of oil fuel when the furnaces used for each fuel are of equal efficiency. If, however, the oil is used wastefully (which is frequently the case), it can be successfully replaced by efficient gas-furnaces. In order to obtain the highest efficiency with such a furnace, it is necessary to feed the rivets through a hopper, so that they are preheated by the products of combustion. In order to take advantage of preheating the rivets in the gas-furnace, there must be a continuous demand for rivets; and if more than one size is required, a furnace with separate compartments becomes necessary.

In repair work a large number of different sized rivets are required during one operation, making it difficult to use to advantage a furnace with a hopper. In certain steel car shops, where new cars only are built, each riveting crew does some particular operation that requires not more than three sizes of rivets. In this character of work, therefore, the hopper or hoppers of the gas-furnace can be continuously filled with rivets of one size, the burners set for heating a certain number of these rivets per hour, and excellent results obtained.

In one repair shop where steel cars were practically rebuilt, each rivet-heater supplied one gang consisting of a riveter, a backer-up, and a rivet boy. These gangs each drive an average of 750 rivets per ten-hour day, or an average of 75 rivets per hour. Frequently the men lost considerable time in changing their working positions and in preparing the parts to be riveted, so the average of 75 rivets per hour was greatly exceeded at some parts of the day. There were about 12 to 15 different sized rivets used on each car—thereby rendering it impracticable to use a furnace with separate compartments for the various sized rivets. It was necessary, therefore, to use a gas-furnace having one large compartment similar to the oil furnace. Tests showed that the average consumption of oil rivet-heaters did not exceed 2 gallons per hour. On a test, extending over several weeks, of the gas rivet-heater, it was impossible to get an average of less than 200 cubic feet per hour. This may seem high; but it was due to the fact that it became necessary to maintain the heater continuously at a very high temperature, in order to heat quickly a few rivets of any size that were required.

It is believed that the same conditions will be encountered in other railroad shops, making it necessary to sell gas at a very low figure in order to compete with oil on a final cost basis. Every individual prospect, however, should be investigated thoroughly. What each railroad company wants is to keep the fuel cost per ton of rivets heated as low as possible; and the market price of oil and gas is only one of the many factors which determine this cost. There are without doubt many shops, using gas efficiently at the price of $1 per 1000 cubic feet, which can show a lower final cost per ton of rivets than other shops which are purchasing oil at 4 c. per gallon, but operating the oil-furnaces wastefully.

Apart from the actual fuel cost, everything is usually in favour of the gas-heater. Oil-heaters give off quantities of smoke each time they are lighted, and as the heaters often go out several times during the day, on account of improper regulation or becoming clogged, the nuisance is very objectionable. The number of rivets burnt in an oil-heater is also quite an item; and one will often notice the rivet boy removing and throwing aside large lumps of rivets fused together.

Metal Melting.

In one of the railroad shops already referred to, 10 tons of brass and 2 tons of Babbitt metal are melted per day. The use of gas in this department depends largely upon the comparative cost of fuels, and with oil at 4 c. per gallon and gas at 70 c. per 1000 cubic feet (each used as efficiently as possible), it is usually very hard to show a saving in favour of gas.

Hardening and Tempering.

Apart from some of the miscellaneous uses taken up in this paper, the author believes that it is in the hardening and tempering room that the gas man should first gain a foothold. In this room all the machine tools—such as reamers, drills, taps, punches, dies, milling-cutters, &c.—are hardened. In most of the larger shops each blacksmith no longer hardens any of the tools he forges or dresses; all this work, even the rougher tools, such as chisels, rail-cutters, &c., being turned over to one or more men who devote their entire time to hardening and tempering. All work of this character can best be done in gas-furnaces; and it is here that all efforts should first be concentrated.

Miscellaneous.

In most locomotive shops oil and gas are now the only competitive fuels for the heating of tyres. As all probably know, the inside diameter of a locomotive tyre when cold is somewhat less than the outside diameter of the wheel on which it is to be placed. By heating the tyre, it is possible to expand it sufficiently to permit of it being slipped over the wheel. When it has cooled it is impossible to remove it until it has again been expanded by heating.

When gas is the fuel, a drilled pipe blast-burner is generally used; the hourly gas consumption for the average tyre-heater being at least 1500 cubic feet per hour. With this gas consumption it takes from 15 to 20 minutes to heat a tyre for setting, while a somewhat less period is required for removing one. When oil is the fuel, seven or eight large torches are mostly used, so arranged that the flame impinges on the circumference of the tyre. Some shops have fire-brick pits in which tyres are placed to be heated for setting. These are provided with portable covers to retain the heat. The diameter of the pits is slightly larger than the largest tyre, and either gas or oil torches are placed tangentially round the circumference. These pits are used only when several complete sets of tyres are to be heated at one time.

There are a great many uses in a railroad shop for large gas-torches, such as straightening locomotive frames, heating buckled plates on steel cars, and heating boiler sheets in order to draw them together. Some of these torches burn 500 cubic feet or more per hour. Their use is very intermittent, and their advantage over an oil-torch is the ease with which they can be lighted; but the total absence of smoke in doing it is also a strong point over oil.

The pipe bending usually done in a railroad shop consists of bending iron and copper pipe for fitting on the locomotives. The bends are usually complicated, making it very hard to apply gas economically. A large coke fire which can be heaped round the pipe for a considerable length, no matter what the shape of the pipe, seems to be more applicable than gas for the work. Gas-forges are often used for heating straight lengths, where it is only desired to bend the pipe in one direction; but it becomes very difficult to use gas for further heating these curved pieces so as to bend them in a second direction.

Light brazing, soldering, and paint burning are all operations which are without doubt best performed with gas; and every effort should be made to obtain this business.

I believe that one of the most important things for the industrial salesman to do when he is installing additional appliances in a railroad shop, or when he is for the first time visiting a shop, is to have a record made of the gas pressure at various points. I am now speaking particularly of the larger shops which are spread

over a considerable area requiring long runs of gas-pipes. If the railroad company have piped their own shop according to their own ideas, the gas-lines are invariably too small; and when it is realized that a large torch consumes 500 cubic feet and a tyre heater 1500 cubic feet per hour, it is easy to see that pipes of large diameter are an absolute necessity. On visiting different large shops, the department foreman has often been asked why they discontinued gas in favour of oil for certain operations. The answer invariably was either that they could not get sufficient heat with gas, or else that the supply was unreliable. The reason for this in the majority of cases was that the lines were too small to stand the intermittent large pulls. In any large shop it is the gas company's duty to see that not only is the pressure at the meter good, but that the pressure at all the consumers' appliances is likewise good.

PIPE FLANGES AND FLANGED FITTINGS.

At the Meeting of the Institution of Mechanical Engineers last Friday, a paper on "The Standardization of Pipe Flanges and Flanged Fittings" was submitted by Mr. JOHN DEWRANCE.

In his introductory remarks the author referred to the attention which has been given in this and other countries to the subject of his paper. Early in 1902, Mr. R. E. Atkinson, of Leicester, read before the Institution a paper in which he dealt with the position of the question at that date. Largely as the result of this communication, the matter was taken up in the following year by the Engineering Standards Committee, who appointed a Sectional Committee on Pipe Flanges to deal with it. The Committee, upon which the Institution of Gas Engineers was represented, nominated a Sub-Committee for the purpose of studying details and carrying out any experiments which might be necessary. Of this Committee the author was a member. The result of their investigations was a report, the issue of which was noticed in the "JOURNAL" at the time, in which flanges, &c., are standardized in four classes: (1) Low pressure, for steam pressures up to 55 lbs. and water pressures up to 200 lbs. per square inch; (2) intermediate pressure, for steam pressures over 55 lbs., but not exceeding 125 lbs. per square inch; (3) high pressure, for steam pressures over 125 lbs., but not exceeding 225 lbs. per square inch; (4) extra high pressure, for steam pressures exceeding 225 lbs., but not exceeding 325 lbs. per square inch.

In the British Standard Tables of Pipe Flanges, the diameters of flanges and bolt-hole circles are uniform for all flanges intended for steam pressures ranging from 55 lbs. to 325 lbs. per square inch; slightly smaller sizes, however, being given for the low-pressure flanges forming Class I., and intended for steam pressures up to 55 lbs. per square inch.

One of the most important points that came before the Sub-Committee for decision was whether or not the number of bolts employed should in all cases be a multiple of four; and a great deal of discussion occurred before a conclusion was arrived at. Cast-iron pipes up to 7-inch bore for hydraulic power up to 1200 lbs. pressure per square inch are made with two bolts. The reason for this is that several pipes are laid side by side in trenches in the streets; but in order to be able to run the pipes in any direction, the standard T bends and the valves must be made in three variations—one with the flanges vertical, another with them horizontal, and still a third with one flange vertical and the other horizontal. This leads to the conclusion arrived at by the Sub-Committee, that there can practically be no standard unless the numbers of bolts used are multiples of four.

The sizes of the bolts were calculated throughout to allow an ample margin of safety, assuming that, in the case of a joint on the point of leaking, the full pressure might be exerted on the area of a circle just touching the inside of the bolt-holes. The clearance of $\frac{1}{16}$ inch in the bolt-holes for $\frac{1}{4}$-inch and $\frac{5}{8}$-inch bolts, and of $\frac{1}{8}$ inch for larger sizes, was, the Sub-Committee thought, the smallest allowance practicable for commercial manufacture.

A very large amount of the time of the Sub-Committee was given to the consideration of the thickness of flanges. Many theories as to the formulæ put forward on this subject were considered; but the Sub-Committee did not agree as to any formula that could be accepted for general use. The author's view is that two separate stresses have to be considered—the first being the stress necessary to distort the flange and the pipe considered as a cantilever, and the second the stress necessary to cup the flange itself. To demonstrate this, a short piece of 2½-inch bronze pipe with two of the standard flanges, 7½ inches diameter and $\frac{11}{16}$ inch thick, was drilled with eight holes to the British standard. One flange was bolted up to a cast-iron flange and the other flange was connected by bolts to another thick cast-iron flange, leaving a space between the bronze and the cast-iron flange. The cast-iron flanges were then pulled apart in a testing-machine. At 17·28 tons the last-mentioned bronze flange set $\frac{1}{32}$ inch, and at 19·2 tons it set $\frac{1}{16}$ inch. Two radial saw-cuts were then made in the undistorted flange. They bisected the distances between one of the bolt-holes and the holes on either side of it, and ran down the radius from the outside circumference of the flange until they met the barrel of the pipe. In this way one-eighth part of the flange was isolated from the rest. A bolt was passed through the hole in the isolated portion, and another through the corresponding hole in the complete flange, and the cantilever strength of the small portion was then tested between the centres of a testing-machine in the ordinary way. A set of $\frac{1}{16}$ inch was obtained with a load of 1·27 tons. This experiment proved that the flange owes 1·27 tons for each section of an eighth, or 10·16 tons in all, to the cantilever strength, and the balance of the 19·2 tons, or 9·04 tons, to the strength of the flange. A flange 6½ inches diameter for a 2-inch pipe, and having four bolts, was then taken and pulled in a similar way. At 14·3 tons there was a permanent set of $\frac{1}{32}$ inch, and at 16·99 tons a set of $\frac{1}{16}$ inch.

The thicknesses of the flanges embodied in the standard tables were arrived at by the Sub-Committee as the result of actual experiments conducted for them. They, however, did not provide for test pressures more than 100 lbs. in excess of the working pressures; and if greater test pressures of the complete pipe-lines were required the thickness of the flanges must be increased.

The Sub-Committee did not make any recommendations as to packings, though they discussed these. The author, however, pointed out that the strength of a flange is much greater if the packing extends over the whole face. Packings which extend only over the surface inside the bolts throw an unnecessary stress on the flange, and tend to cup it and cause it to break away from the pipe.

Some manufacturers hold that by using their own standard sizes of flanges they influence their customers to come to them for renewals and additions of plant; but as they must also be prepared to supply to British standard sizes, the author considered it probable that any advantage they gain by retaining their own standard is counterbalanced by the extra cost of using two standards. The British standard for pipe-flanges is certainly the most largely adopted at the present time; and the author suggested that members of the Institution who have not already adopted it, should give the matter their careful consideration.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

Visit to Messrs. R. & A. Main's Falkirk Works.

Members of the Scottish Junior Gas Association (Western District) and their friends, to the number of 80, paid an instructive and interesting visit on Saturday to Messrs. R. & A. Main's Gothic Iron-Works, Falkirk—the occasion inaugurating the second half of the session's work of the Association. Since the last inspection of the works by the Junior Gas Association several years ago, Messrs. R. & A. Main have carried out extensive improvements and additions to their premises. The visitors, who were shown round by several members of the firm, were naturally engrossed by the examination of the great variety of the appliances for the consumption of gas seen in the process of manufacture—the novelty perhaps being the enamelling shop, which is capable of dealing with all classes of enamelling specialities. The tour of the works was thoroughly made, starting from the pattern shop and finishing with a demonstration of the process of enamelling the latest models of gas-fires.

For the use of the visitors, a *souvenir* was distributed containing a series of well-executed views of the exterior and interior of the works, accompanied by descriptions of the shops and illustrations of some representative types of "Main" manufactures, preceded by a sketch of the history of the firm's connection with Falkirk. From this pamphlet the following particulars are taken.

THE FALKIRK WORKS OF MESSRS. R. & A. MAIN.

HISTORICAL.

The history of Messrs. R. & A. Main's connection with Falkirk as their Scottish centre of manufacture may be said to date from 1897, the year of their amalgamation with the London firm of Messrs. Thomas Glover and Co., Limited. Prior to this period, their sole factory was at Park Street, Kinning Park, Glasgow. Insufficiency of space to deal with the rapidly increasing business, and notably lack of foundry accommodation, compelled the firm soon after the amalgamation to consider how best to extend their manufacturing capacity; and, with a view not merely to the immediate future but to the ultimate requirements of the business, it was decided to remove the whole of the works from Glasgow to Falkirk. This decision was amply justified by results. The site selected is slightly under two miles from Grahamston Station, between the Glasgow and Edinburgh main road and the joint Caledonian and North British Railway. Land to the extent of 10 acres was acquired, and ample railway siding accommodation provided for. As originally laid out, the works buildings covered an area of 2½ acres. Manufacturing was commenced in 1900, and scarcely a year has since elapsed without the need arising for extending in one department or another, with the result that the shop area now represents nearly 4 acres.

As already stated, prior to the removal to Falkirk, the Kinning Park works were the sole source of the firm's gas-stove supply. Since that date, in addition to the Falkirk works, there has been developed, in conjunction with Messrs. Thomas Glover and Co., a modern works covering 7 acres at Edmonton, of which nearly half is occupied in the manufacture of gas-stoves, and fully capable of dealing with the requirements of the district, while a branch works in Birmingham is responsible for Midland business. The

result is that while fifteen years ago a large proportion of the firm's output was despatched to the South, the present greatly devoloped Falkirk works are almost entirely devoted to supplying home requirements. This speaks well for the development of the gas undertakings throughout the whole of Scotland.

Description of the Shops, Plant, Etc.

In the pattern shop there is ample accommodation for 24 pattern makers working under bright and comfortable conditions. Here is seen the initial stage of gas-stove construction, the patterns and models being built up of white metal or wood. From them are cast the "original" or "master" patterns in iron, and from the latter the working or plate patterns, also in iron; the last named being a modified type of pattern embodying more than one article on each plate, and used for repetition work and making in large quantities. The adjacent shop is devoted to the preparation of all iron patterns. In conjunction with the pattern shop is the pattern store, where all patterns are carefully kept. These amount to many thousands in number, and are essentially of great value to an ironfounding business.

The moulding shop is capable of turning out 35 to 40 tons of castings daily, and it can find employment for 150 hands. It is heated in case of severe frost by special coke-stoves of the firm's own design, and is well lit throughout by inverted burners of the Bland type. This system of lighting is used with great success throughout the whole of the works and offices. The core shop is worked in conjunction with the moulding shop for supplying all the sand cores for hollow castings, such as burners, gas-radiator tubes, &c. The cores are moulded with a specially prepared mixture of sand, and baked in a large coke-heated drying-oven, whence they are wheeled on bogies to the spot where this particular class of work is being made. At the end of the moulding shop are stationed two cupolas for melting the iron, each with a melting capacity of 15 and 20 tons per hour respectively. The air-blast for these is supplied from a Roots blower fixed in the engine-room, and delivering air under pressure to the cupolas.

On leaving the moulding shop the castings are taken to the dressing shop for the purpose of being trimmed and dressed-up, all rough edges being removed by the emery wheel. The smaller castings are cleaned in a "rumbler"—a species of iron barrel which is filled with the castings to be treated, and revolved continuously for a certain period, the castings thus cleaning themselves by inter-friction. From the dressing-shop all the castings are handed over to the passer and his assistants, who carefully examine every article for flaws and defects, passing on only castings of good quality, at the same time keeping count of all the articles made. The castings are then removed to the castings warehouse for use when required.

Adjacent to the dressing department is centralized the power equipment of the works. This comprises a steam-boiler of a capacity of 130 B.H.P., and a Robey horizontal steam-engine capable of developing 85 B.H.P. Since the installation was put up, a low-pressure cylinder has been added, giving an increased horse power to the extent of 60 per cent. To ease the working load in the afternoons, and to act as a stand-by source of power, a gas-engine of 60 B.H.P. was put down last year. This is usually required to run the blower supplying the cupola blast.

The grinding-mill serves as the polishing department for all castings required to be thus treated. The castings are handled on grindstones which are initially of 72 inches diameter, but which get rapidly reduced in circumference owing to the heavy wear put upon them; also on polishing-machines, the wheels of which are built up of specially prepared walrus hide and faced with emery. A new shop has been opened, fitted with the most up-to-date plant for removing the dust given off from the wheels during the process of polishing, and for keeping the atmosphere in good condition.

In the smithy all the malleable ironwork connected with the manufacture of gas-stoves is dealt with. Here also the parts for all types of cooker grid shelves and gate fittings are cut, folded, punched, and riveted together. Six blacksmiths' forges are in operation, in addition to cutting, folding, and punching machines. All castings required to be drilled or bored are handled in the boring shop. A large portion of the space is devoted to burners, the jets of which have all to be separately drilled to ensure burning with an accurate flame.

The main fitting shop is divided into three sections—viz., the light fitting shop, the heavy fitting shop, and the sheet-iron and tinsmiths' shop. The two former deal with the assembling of all stove work, both large and small, varying from a large central cooking range for a hotel kitchen to a hob range plate. The last-named department is devoted to sheet-iron work and the manufacture of tin-ware for cookers. The general store and castings warehouse are in close connection with the fitting shop, so that material may be handed out to the fitters without delay. A large new castings warehouse is in process of erection.

The finishing and plating shops are run in conjunction, and supply the high finishes required other than Berlin blacked or enamelled, such as armour bright, brass, bronze, or nickel-plate. Here also are finished off the many varieties of brass mouldings and ornaments which have become such a feature of the "Main" gas-fires in recent years. In addition a great deal of work in the way of nickel-plating, electro-brassing, and bronzing is done for the trade generally. All goods sent out in Berlin black finish are expeditiously dealt with in the Berlin black shop; the paint work being stoved in three large stoving-ovens heated from outside furnaces to ensure the interior of the shop being kept clean and free from dust. This is a new and larger shop than the one in which the work was formerly carried on, this having been converted into a garage, as the firm have inaugurated the system of delivering goods by motor lorry. The enamel shop is capable of dealing with all classes of enamelling specialities—a fact borne out by the variety of articles sent for enamelling by other manufacturers, in addition to the firm's own enamelled goods.

Once the various articles are complete, they are transferred to the packers, having to undergo *en route* the "ordeal of the test" at the hands of the testing department. Here they are carefully inspected for good finish, gas-cocks and connections are examined, and, what is no less important, burners adjusted. Bearing in mind the different qualities of the gas supplied at the various destinations of the appliances involved, this is a matter for no little discrimination. It is no part of the firm's organization to allow goods to remain in the packing department. All articles must immediately take one of two roads—either to the loading bank, where railway waggons daily await their arrival, or else to the adjacent finished warehouse, ready for the prompt execution of urgent orders.

The party were afterwards entertained to tea in the Company's offices.

Mr. A. P. Main, who presided, expressed the pleasure it had been to the firm to receive the Association. They had done the best to show their visitors the different processes which go to make up that most useful of all articles, a modern gas-stove. Speaking specially to the young men, he hoped that as they went through life they would be proud of being associated with an industry which, in its own way, had done more to brighten the lives of women and of the housekeepers of this country than perhaps anything else—lessening the drudgery of their labour and increasing the happiness of their homes. It was surely something to be proud of that they were, while pushing their own trade, as every man ought to do with the hope of receiving due reward, also contributing to the general welfare and happiness of the nation. What a revolution there would be if an attempt were now made to deprive the householders of the country of the gas-cooking stove and the gas-fire. It was extremely interesting to think that in one generation these appliances had proved themselves indispensable, though at the beginning they were, like many other of the best things in the world, frowned upon and despised. They were told in these fast days of opposition that it was hopeless to attempt to persuade anybody to use a gas-stove for cooking. It required a certain amount of pluck to face all the opposition, to believe that what they were doing was right and good. They saw the fruits of it to-day. They had established a new method of cooking which the country could not do without. The gas engineer to-day, in pushing the sale of gas for cooking and heating, was promoting one of the prime necessities of existence. He was saving labour, saving dust, and saving all that made much of the household work harassing to women folk. Some of them had not been in these works before, and they might not be aware of the fact that on the very spot which they occupied there was once a foreign army of occupation. It was a singular thing in these days of war to think that round these very fields had been a Roman army—that this spot was once the western limit of the Roman dominions. They found when they were building the works heating chambers and domestic implements of those who were then in possession.

Mr. David Fulton (Helensburgh), the Acting Chairman of the Association, expressed the gratefulness of the members to Messrs. R. & A. Main. He did not think there was any member of the Association present who had not put through his hands the appliances made by the firm and who had not had experience of the very high quality of their material. In future they would take even a greater interest in these appliances. He moved a hearty vote of thanks to the firm and to the gentlemen who had so kindly shown them round the works. He had sent the following telegram to Mr. Carmichael, the President of the Association, who was unable to be with them: "Successful and memorable visit. All good wishes, Everyone."

Mr. Aird, in replying for Messrs. R. & A. Main, said he hoped the visit had been instructive. It had been instructive to the firm. It was a good thing for any works to feel that interest was being taken in what they were doing. He was sorry they had not been able to show their visitors as much as they might have done at other times. It was now the slackest time of the year for manufacturers of their class. They were also handicapped owing to the war. He was proud to say that a large number of their men had joined the army—he thought the percentage was nearly 25.

Mr. Main, in calling upon Mr. Wilson, of Coatbridge, to say a word, remarked that Mr. Wilson had occupied the position of Gas Engineer in the town of Coatbridge for about 35 years. He had distinguished himself, as they knew, by the extremely successful conduct of the undertaking; and he believed he had maintained during all these years the maximum dividend while producing the cheapest gas in Scotland. He had another title to fame, not only having occupied his position for so long, but in having his son the Engineer of the Falkirk Gas Department.

Mr. Wilson, in a characteristically humorous speech, said that what the members of the Association had seen on their visit must be an education to them. One wondered when they saw such huge works how they could get orders to keep them running. If he was not the first, he was the second in Scotland to let out gas-stoves for hire. His cousin in Dundee was the first. In his connection with the Mains, he could go back to Waddell and Main. Speaking of the days, some 28 years ago, when he first had business with the firm, he remarked that he was then making 50 to 60 million cubic feet a year; now the figure was 256 millions. Their day consumption now was higher than their night consumption. If it had been profitable to the stove makers, it had been profitable to the gas companies. Coatbridge was in a better position than Glasgow. Out of 10,000 consumers they had over 7000 stoves; and 90 per cent. of these had been made in the works they had visited.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Gas Companies' Coal Supply.

SIR,—Under the circumstances detailed in the enclosed leaflet, issued by the South Metropolitan Gas Company, I find that, owing to a misunderstanding of the clerk of one of the contractors to the Wandsworth Gas Company, I am held responsible for having established a calamitous precedent, and am naturally open to severe obloquy for having contracted with the Government Agent to pay 13s. 3d. freight from the Tyne to the Thames. I wish to explain that though I had authorized the contractor to pick up any freightage in addition to certain very moderate increase on his own boat's carryings, I find that he, no more than myself, expected that his clerk would give such a rate. The transaction was communicated to Mr. Carr only when too late. I wish to say that there was no urgency, in the way of short stock, to vindicate such a rate; and I am asking the contractor to protest against it, and to take no more such rates. It means that there will be a direct loss on all the gas sold of all the profit for dividend and about 8d. per 1000 cubic feet beyond. If the Government want London to go without fuel and light, this unfair exaction is a short road to it; and our shareholders will regret having given £1000 to the Prince of Wales's War Fund when they find themselves being so unjustly treated by the authorities.

The leaflet shows how inconsiderately the coal and gas users have been treated in this issue. This is not confined to the Metropolis. All through the Southern Counties extreme hardships have been inflicted, and, in my opinion, without sufficient thought. The Gas Companies' Protection Association has been appealed to, and has made urgent representation to the Government. Every Member of Parliament should be supplied with the facts.

HY. E. JONES,
Chairman of the Wandsworth, Wimbledon, and Epsom Gas Company.

Gas-Works, Wandsworth, Jan. 23, 1915.

[The leaflet enclosed by Mr. Jones is referred to in "Miscellaneous News." The receipt of the preceding letter from Mr. Jones affords an opportunity for correcting a misreading, owing, as he acknowledges, to his "imperfect caligraphy," of a word in the opening paragraph of his letter on "Coke for Steam-Raising," which appeared in the "JOURNAL" last week (p. 148). The word at the end of the fourth line should have been "convincing."—ED. J.G.L.]

REGISTER OF PATENTS.

Recovery of Bye-Products from Coke-Oven Gas.

TWYNAM, T., of Redcar.

No. 1820; Jan. 23, 1914.

This invention relates to the utilization of coke-oven gas, and the recovery of bye-products therefrom—more especially in cases in which the gas is in excess, and there is no immediate use for the power which could be generated from its combustion either under steam-boilers or in gas-engines or otherwise. At many collieries and at iron and steel works, the patentee points out, coal is now being converted into coke in coke-ovens, and of the gas produced during such conversion only some 50 to 60 per cent. is actually required to supply the requisite heat to the coke-ovens, &c., to carry on the operation. "As such collieries or other plants are quite usually in isolated positions, where there is no immediate use for the excess of gas, this latter is in many cases put to uses in which its value is not utilized to any advantage. It is usual to recover the bye-products from the whole of the gas; and of these bye-products, the ammonia is commonly fixed and obtained as sulphate of ammonia, by interaction with sulphuric acid obtained from outside sources."

His invention proposes to convert whatever spare gas there is into electric energy, either as three-phase direct or alternating current, by combusting the gas in any suitable engine, or burning it under steam-boilers, &c., and converting the mechanical energy thus produced into electric power. He proposes to utilize the electric energy in any form of electric furnace or apparatus adapted to the direct combination of the nitrogen and oxygen of the atmosphere into nitrous gases, and ultimately into nitric acid. The nitric acid thus formed is absorbed in towers in the usual way, and is obtained from such towers at a strength of from 33 to 50 per cent. real acid. He utilizes the acid produced to combine with the ammonia from the coke-oven gas, either by passing the coke-oven gases directly into the nitric acid absorption towers (after freeing the gases from tar) or else brings the ammonia containing gas into intimate contact with the acid—preferably after cooling the gas to about atmospheric temperature. By employing a fairly strong solution of ammonium nitrate, to which some free nitric acid has been added, part of the ammonium nitrate may be caused to separate-out from the cooled liquid in a crystalline condition. It is sometimes convenient, he says, to absorb in the nitric acid that part only of the ammonia which is distilled from the ammoniacal liquor; leaving the larger part of the ammonia to be absorbed by sulphuric acid as at present.

He adds that he is aware that it has been proposed to utilize waste gases (such as coke-oven gas) by burning the gas as the heating or explosive element for operating an engine which actuates a dynamo for the production of an electric arc for making calcium cyanamide, carbide of calcium, or carbon bisulphide; and it has also been proposed to recover the ammonia in coke-oven gas by bringing the gas containing the ammonia or uncombined ammonia recovered from the gas, into contact with nitrogen oxides or oxyacids obtained by combustion with nitrogen and oxygen of gas which has already been freed from ammonia.

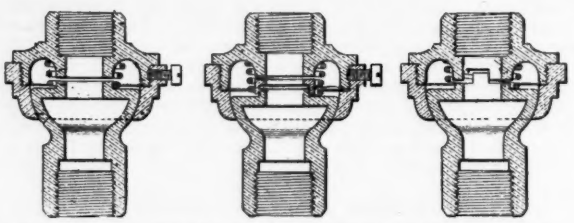
Ball-Joints for Gas-Lamps.

JOHN RUSSELL AND CO., LIMITED and REASON, H. L., of Birmingham.

No. 3314; Feb. 9, 1914.

This ball-joint is of the "type having an internal stop device for limiting the movement of the one member of the joint relatively to the other member, so as to prevent the escape of gas, and, where it is intended to use the joint in connection with outside gas-lamps for shops or other purposes, having means to prevent the lamp from being blown round."

According to one known arrangement (applied to a ball-joint for a swinging electric lamp pendant), the upper edge of the ball or spherical member has been made to engage with an adjustable screwed internal flange on the fixed part in order to limit relative movement of the two parts of the joint; while in another construction a central annular collar upon the ball member engages within the interior of an annular collar or sleeve on the fixed part, so that its outer or side face is adapted to abut against the inner face of the collar, in order to limit the relative movement.



Reason's (John Russell and Co.) Ball-Joints for Swinging Lamps.

According to the present invention, however, the stop for preventing the relative rotation comprises a central annular collar or raised part on the one member, which is adapted to engage with the end of a central sleeve upon the other joint member—the collar and sleeve being normally separated. And to limit the rotation of the lamp a gap is formed in the collar or raised part of the one member which is engaged by a projection on the sleeve of the other member.

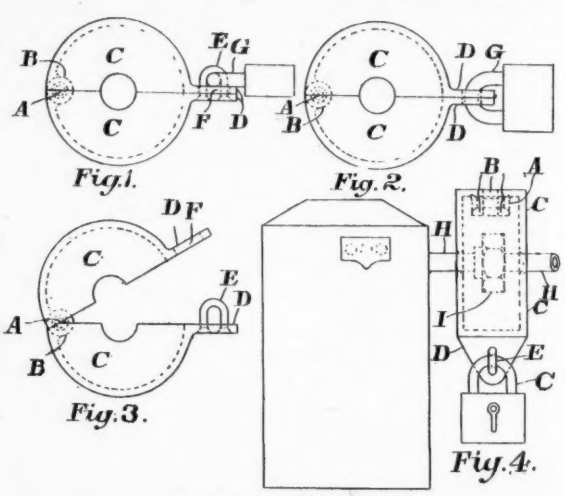
Three vertical sections through a ball joint constructed in accordance with this invention are shown; in the third case means being provided for preventing the two joint-elements from being turned round relatively to one another in a horizontal plane.

Device for Locking Gas-Meter Connections.

CORCORAN, H., of Bray, co. Wicklow.

No. 18,085; July 31, 1914.

This invention relates to the class of locks for protecting the union-joints of gas-meters and the like, formed in two half cylindrical sections, each concavo-convex in cross section; but it is said to differ from the prior arrangements in that the important hinged connection for the two half cylindrical sections is disposed internally instead of being outside of the sections. It cannot therefore be tampered with or opened.



Corcoran's Gas-Meter Connection Locking Device.

As shown, the spindle A is riveted over at each end in the hole in the internally disposed bosses B, so that the spindle is secure "and wholly contained inside the locking device." Fig. 1 is an end elevation of the invention in which the cylindrical box C is shown made in halves hinged inside on the bosses by a spindle. The box is flanged over and outward at D to receive the fastener C, which is embedded in, or integral with, the lower flange, and projects through a slot F in the upper flange in order to receive the lock G. A hole is made in the centre of the device at each end (half in the upper half and half in the lower

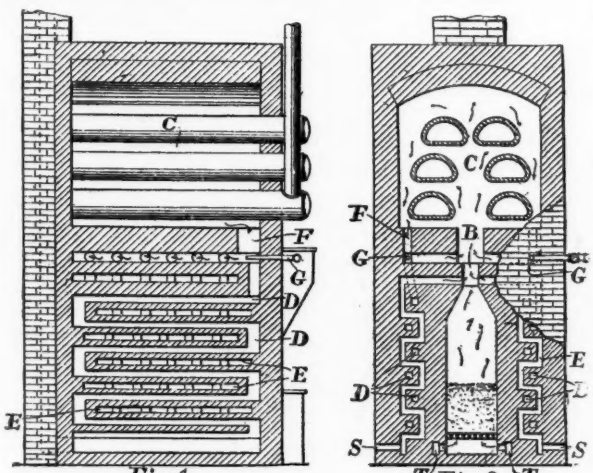
half), in order to encircle the union pipe H (fig. 4). Fig. 2 shows an end elevation of the device with a hole through the flanges D to receive the lock in place of the fastener E shown in fig. 1. Fig. 3 shows the seal removed and the device partly open. Fig. 4 is a side elevation of the invention in place—encircling the pipe union I and the pipes H, with the lock in the position it would naturally assume.

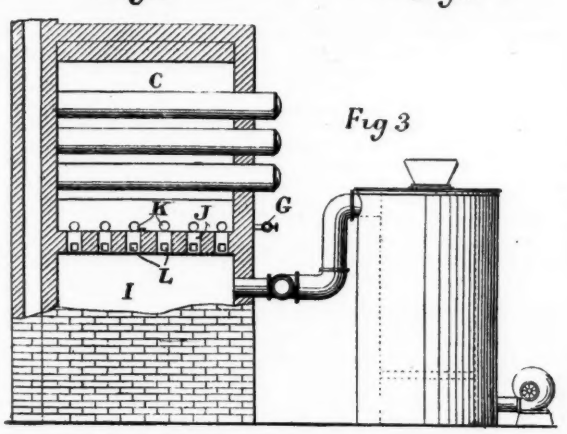
Regulating the Temperature of Combustion.

GLASGOW, A. G.; a communication from J. M. RUSBY and J. H. TAUSSIG, of Philadelphia, U.S.A.

No. 12,256; May 18, 1914.

This invention has for its object "to regulate or control the temperature of combustion of a mixture of air and combustible gas." The patentees remark that in connection with apparatus for the combustion of liquid fuel in furnaces, and in order to reduce the calorific intensity it has already been proposed to spray the liquid fuel by means of a quantity of air under pressure insufficient for its complete combustion, and then to gasify the spray by dilution with hot combustion products—the mixture thus formed being led through a tube into the furnace. "The conditions requisite for effectual combustion, however, are not satisfied, and such combustion is not established prior to dilution with incombustible combustion products." But according to their present invention a burning mixture of undiluted homogeneous producer gas and undiluted air sufficient for its combustion is first set up, and the temperature effect of combustion is then regulated by adding to the products of the burning mixture a diluent consisting of incombustible products of combustion.





Rusby and Taussig's Retort-Heating Arrangement.

The drawings accompanying the specification show two of "many forms of apparatus in connection with which the invention may be practised." Fig. 1 is a longitudinal section of a coal-gas retort-bench; and fig. 2, a transverse sectional view. Fig. 3 is a view (partly in longitudinal section) illustrating a modified construction of a coal-gas retort apparatus.

In figs. 1 and 2, a supply of combustible gas is maintained within the chamber A by generating it in the chamber; and the path of travel of the gas is through the passage B to the retort-chamber C. In B the gas is ignited by the addition of secondary air; and products of combustion are thereafter added to it, so as to regulate or control the temperature effect. The flues D of the recuperator receive the products of combustion from C, and they range from front to back of the setting alternately and downwards, and then connect with the chimney stack. Secondary air, entering, for example, at S, traverses the flues E of the recuperator and is introduced into the passage B, causing ignition of the gas which is generated in A and permitting of its subsequent combustion in the retort chamber. Some of the products of combustion which would ordinarily pass to the stack are introduced as a diluent in the passage B. This is accomplished by the passages F that lead to the flues D, and to specially provided flues that run lengthwise and in the direction of the flues D and have communication by openings with the passage B, beyond the zone of ignition. In these flues injectors G are shown, which ensure the passage of the products of combustion from the retort chamber, through the flues, and to the passage B. The injectors (operated by any appropriate means) "are merely illustrative of some appliance or appliances for introducing products of combustion." T are flues which (by ports) deliver air into the chamber A, for use in generating gas from any suitable fuel therein.

In the arrangement shown in fig. 3, the fluid combustible is generated in a producer H, which constitutes a separate piece of apparatus from the retort-bench and may be common to a number of retort-benches. In this construction, gas from the producer enters the chamber I, instead of being generated in the chamber; otherwise the construction and mode of operation are the same as with figs. 1 and 2—that is to say, the gas rises from the chamber I into the passage J. In this passage the products of combustion are discharged from the openings K, and secondary air is admitted from the openings L.

The retorts are arranged in the chamber C, and, "by reason of the described control of the temperature of combustion, they are evenly heated—that is to say, those at the bottom are not unduly heated."

LEGAL INTELLIGENCE.

PREFERENTIAL CHARGES FOR ELECTRICITY AT ILFORD.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, Jan. 20.

(*Before Mr. Justice* SARGANT.)

Attorney-General (at the Relation of the Ilford Gas Company) v. Urban District Council of Ilford.

In this action the plaintiffs sought (1) a declaration that defendants had no power to carry on the trade or business of providing, selling, or letting on hire, electric lamps, electric heating or cooking apparatus, electric motors, or other electric fittings or apparatus, &c.; (2) a declaration that defendants had no power to provide a showroom for the exhibition of any such electric lamps, motors, fittings, &c.; (3) a declaration that defendants had no power to maintain, repair, or cleanse electric motors, meters, fittings, apparatus, &c.; (4) a declaration that defendants had no power to expend, or use for any of the apparatus mentioned, any of their moneys, plant, property, or servants; (5) an injunction to restrain defendants from committing any of the acts mentioned; (6) a declaration that the reduction in price for electricity proposed to be made by defendants in respect of houses, shops, warehouses, workshops, &c., electrically lighted throughout constituted an undue preference to the owners and occupiers of such premises, and was in contravention of sections 19 and 20 of the Electric Lighting Act, 1882; (7) an injunction to restrain defendants from giving by the means aforesaid, or otherwise in connection with the supply of electricity by defendants, any undue preference to owners or occupiers of premises electrically lighted throughout; (8) costs of the action.

Mr. MARK ROMER, K.C., and Mr. TYLDESLEY JONES (instructed by Messrs. Torr and Co.) appeared for the plaintiffs; Mr. MARTELLI, K.C., and Mr. DRUCQUER (instructed by Messrs. Taylor and Taylor, agents for Mr. Adam Partington, of Ilford) for the defendants.

Mr. ROMER said he understood the defendants were now willing to submit to judgment; but they sought to impose certain terms and conditions. The action was in reality in two branches. First of all plaintiffs claimed a declaration that the defendants were acting *ultra vires* in carrying on business for the supply of arc lights and other electric appliances, and providing a show-room for the exhibition of such apparatus. The first four declarations related to these businesses.

His LORDSHIP: It is rather like the Sheffield and Leicester cases.

Mr. ROMER agreed, and said there was no question it was *ultra vires* to carry on this class of business. No. 5 claimed an injunction restraining the defendants from committing any of the acts referred to in the four previous claims; and No. 6 was for a declaration that what defendants were doing constituted an undue preference under the Electric Lighting Act. It was quite clear that the new tariff which defendants proposed was *ultra vires*, because they were offering lower terms to houses electrically lighted throughout; and plaintiffs asked for a declaration that the reduction in price for electricity to houses electrically lighted throughout constituted an undue preference, and for an injunction restraining the same. The defendants agreed to all the declarations asked for; but so far as regarded the injunction as to electric lighting preference, they suggested that there should be liberty to apply for an injunction, as in the Long Eaton case. As regarded the other declarations, plaintiffs were willing that there should be liberty to apply for an injunction. Defendants said they had agreements with customers, which plaintiffs had not seen, for the supply and maintenance of arc lamps and motors; and there were 118 agreements for the hire of electric motors. Defendants wished some provision inserted in the order to the effect that, although plaintiffs were to be at liberty to apply for an injunction, yet they were not to apply in regard to any agreements which were in force for twelve months. Plaintiffs could not consent to this, though they were willing to agree to three months. With this limitation, he was willing that the order should be varied as defendants suggested.

His LORDSHIP: What is the length of these agreements?

Mr. ROMER: They are all *ultra vires*.

Mr. MARTELLI: Some are for five years, and some for one year. The only question is how long your Lordship will give us to make the best terms we can with the people with whom we have agreements. I assent that the agreements are *ultra vires;* but if we simply try to take possession of the motors, the result will be that a number of works will have to be shut up, and many people thrown out of employment.

Besides this, defendants will have considerable difficulty in getting back the arc lamps, wires, and motors; while the plaintiffs are seeking to get these items disallowed. As, however, they amount to some thousands of pounds, for which the councillors may be surcharged, we want to make the best terms we can with the people who have them in use. Our experts say it is impossible in the case of the arc lamps for the customers to make alternative arrangements with the Gas Company for some time to come.

His LORDSHIP: Cannot they get the lamps from other people?

Mr. MARTELLI: No doubt they can; but the motors will take some time to arrange.

Mr. ROMER: I suggest that the case should stand over, as we cannot accept the proposal. We have not seen the agreements.

Mr. MARTELLI: You have seen all except what have expired.

His LORDSHIP pointed out that the parties were applying for an order by consent; and if they were not agreed on the terms, the case must stand over.

Mr. MARTELLI said they would never agree if plaintiffs insisted on such terms; and he suggested that it was for his Lordship to say what was a reasonable time.

Mr. ROMER said it was not a case of a suspension of the injunction, as the injunction would not exist after the expiration of three months. If defendants made out a good case at the end of three months, there would be no need to apply.

Mr. MARTELLI said he did not object to the case standing over; but he thought there was not much hope of the parties coming to an agreement as to time. He admitted that the agreements were *ultra vires*, and had submitted to the declarations and injunction; but as to the motors and arc lamps, the only question was what time the Court would give them.

His LORDSHIP said as there appeared to be a difference of opinion on both sides as to the length of the agreements, the case had better stand over.

Mr. MARTELLI said the agreements which had been disclosed showed that in some cases they were for a period of five years, and in others one year. Plaintiffs had merely an imaginary grievance. They said the defendants had not disclosed all the agreements; and this was true to the extent that those which had expired had not been disclosed. But they should all be produced.

Mr. ROMER could not understand why there should not be a declaration, with liberty to apply for an injunction; and if the plaintiffs did apply, the Court might either refuse the application or suspend the injunction for three or six months.

Mr. MARTELLI said if an injunction was applied for at once with regard to some of the agreements, it would not be granted.

His LORDSHIP said if there was a motion for an injunction, and it was granted, and not obeyed, sequestration would be the result.

Mr. MARTELLI: What my learned friend asks for is a declaration, with liberty to apply for an injunction.

His LORDSHIP: And they say they will not apply for three months.

Mr. ROMER: I hope we shall not apply at all. If we find defendants are doing their best to put an end to the agreements, we shall not apply at all.

Mr. MARTELLI: My friend applies for a declaration that defendants have no power to carry on this trade or business; and with regard to arc lamps we shall make the best terms we can with customers to get rid of them—probably we shall sell them to the persons using them. Our view is that we are justified in selling them, so as to cut our loss.

His LORDSHIP: To sell them out and out?

Mr. MARTELLI: Yes, and so reduce the amount which, if we are surcharged, we shall suffer.

His LORDSHIP: Where defendants have let these things out on hire, have plaintiffs any objection to their selling them to customers?

Mr. MARTELLI: Our view is that this is not carrying on the business; but as we cannot get any mercy from plaintiffs we have to make the best terms we can.

His LORDSHIP: If I grant the declaration, and an injunction were applied for merely on the ground that the defendants were selling a motor or an arc lamp which was already in use, I do not think I should grant it.

Mr. ROMER: I would much prefer the case to stand over with that intimation, as any compromise has to be sanctioned by the Local Government Board. Your Lordship will give liberty to apply for an injunction; and if I apply my friend can raise all these points, and the application will be either granted or refused.

Mr. MARTELLI: The cost of these things will be disallowed, as they are *ultra vires;* and as we shall be surcharged with any loss, we want to cut our loss.

His LORDSHIP: I do not think it would be unreasonable for defendants to sell to customers any one of the articles which they have let to them.

Mr. ROMER: If this had been an *ultra vires* business I suppose the members of the Council who took part in it would be responsible; and as they would be surcharged they can cut their loss. But we are dealing with the Urban District Council.

His LORDSHIP: They can cut their loss.

Mr. MARTELLI: The Council are the owners of the arc lamps.

His LORDSHIP: If the members of the Council are surcharged, the cost would go to their credit against the surcharge.

Mr. MARTELLI: We apprehend there will be a motion, and we wish to say that this is not carrying on a trade or business. In making a declaration, there is no admission. This comes within the decided cases. There is no doubt that all these things go beyond the place where the electricity is supplied—that is to say, the terminals. We ask that the declaration should not go beyond that of the Long Eaton case.

His LORDSHIP: There will be a declaration, with liberty to apply for an injunction.

Mr. ROMER: And the defendants will pay the costs of the action. We have applied to see the agreements; and I understand my friend will now produce them.

Mr. MARTELLI: We have said we would do so, and we will not go back upon that, although I suppose they are wanted for the purpose of the surcharge.

WORKMAN'S COMPENSATION CASE AT SOUTHAMPTON.

At the Southampton County Court last Tuesday, His Honour Judge GUY had before him a case under the Workmen's Compensation Act; the applicant being Jesse Faulkes Stride, a blacksmith's striker, and the respondents the Southampton Gas Company.

Mr. G. C. KINGSBURY (instructed by Messrs. C. A. Emanuel and Emanuel) represented the applicant; Dr. S. H. EMANUEL (instructed by Messrs. Lamport, Bassitt, and Hiscock) appeared for the Company.

Mr. KINGSBURY stated that the applicant had been in the employ of the Company for nineteen years prior to the accident which was the subject of the arbitration, and which occurred in June, 1912. On that occasion the applicant was engaged with a blacksmith in removing a bar of iron from a rack for use at the forge, and the bar being displaced suddenly, threw him on to the forge, the fall causing him great pain in the back and down to his foot. He was treated at the hospital, and subsequently returned, eight weeks later, to the gas-works; being then capable of light work only. Following an attack of unconsciousness, he was sent home again, and was in bed for six weeks. As his powers of walking failed, he was advised to go to London, and was treated at the National Hospital for Paralysis for a period of about eight weeks. No real improvement took place in his condition, which was the same now. Half wages were paid from the time of the accident up till July, 1913 (save for the period when Stride was engaged on light work, when full wages were paid), after which time the weekly payment was reduced from 13s. to 10s. a week; the latter payment being, the respondents contended, reduced compensation without prejudice.

Dr. EMANUEL said the Gas Company and the Insurance Company had never disputed the accident, or their liability to pay half wages up to the time the man was cured; the point of difference being whether (or not) he was cured when he came out of the National Hospital, and if not what compensation ought to be paid. The payment of 10s. a week from July was, Counsel added, an *ex gratia* one, conditional on the applicant bringing proceedings at an early date.

Applicant, who gave his evidence from a bath-chair, described the accident, and said his walking powers became gradually worse notwithstanding the doctor's and the Hospital treatment, and the pain was continuous.

Dr. *W. P. Purvis* and Dr. *W. P. O'Meara* gave evidence to the effect that applicant was unfit for work.

Dr. *E. Farquhar Buzzard*, F.R.C.P., and Mr. *G. H. Cowen*, F.R.C.S., expressed the opinion that there was no organic disease.

Dr. EMANUEL urged that 10s. a week was a sufficient figure of compensation.

Following a consultation between the Judge and the Medical Assessor, his HONOUR expressed the opinion that the applicant would be capable of working in a short time, though he was incapable of doing so now. As an incentive the man would receive compensation at the rate of 10s. instead of 13s. a week.

An award for this figure was entered. Costs were granted to the applicant; the respondents being given liberty to apply.

Liability for Gas-Fittings.

At the Edmonton County Court last Tuesday, the case in which the Tottenham District Light, Heat, and Power Company sued Mr. Charles Smith, builder, for £13 1s. for "running supplies" was again heard. It was before the Court on the 7th ult., as reported in the "JOURNAL" for Dec. 15. The defendant was the Director of a picture palace at West Green, to which the Company supplied fittings and gas. He paid the gas bill, but denied liability for the "running supplies." On the previous occasion, it was said that defendant's co-Director, Mr. Thorn, was now in possession of the cinema; the Company having been in liquidation. The case was adjourned for the attendance of Mr. Thorn; but he did not now appear, though he had been subpœnaed. Judgment was given for the plaintiffs; but a stay of execution was granted until the 15th of March, to give him the opportunity to proceed against Mr. Thorn, if he deemed it advisable.

Claim for Damage through the Removal of Gas-Fittings.

At the Redhill County Court last Wednesday, before his Honour Judge Mackarniss, the Redhill Gas Company sued Harry Frederick Sleap for £13 18s. 6d. The case was before the Court at the previous sitting, when the defendant admitted his liability, but obtained leave to bring a counterclaim. The plaintiffs were applied to by the defendant to remove the gas-fittings from his house at Purley to another at Kingswood, and he accepted an estimate of £4 13s. 2d. for the work. After this was done, he received from his landlord a complaint of damage to the premises at Purley. He thereupon wrote to the plaintiffs, who replied that an independent person should be sent to see the alleged damage. In a further letter defendant suggested that they should each bear one-half the cost. He was sued by his landlord in the Croydon County Court for the damage done to the premises, and judgment for £5 was obtained. The damage was caused by removing the gas-blocks from the walls. A surveyor was called who said that had the blocks been fastened into the walls without wooden plugs no damage would have been done in removing them. Arthur Wakerell, who had charge of the removal of the fittings, said the blocks were nailed to the brickwork; there was not a single wooden plug for them in the walls. No unnecessary force was used to get them away. In one case a little damage was done to the plaster of the wall. His Honour said that, in order to succeed on the counterclaim, defendant had to make out that there was negligence on the part of the plaintiffs. In his opinion, what was done was clearly in pursuance of the instructions of the defendant, who was ignorant of how the gas-fittings were fastened into the wall. The evidence pointed to the fact that the work was done as skilfully as possible in the circumstances. The counterclaim must therefore fail, and there must be judgment for the plaintiffs on the claim and the counterclaim.

MISCELLANEOUS NEWS.

GLASGOW PUBLIC LIGHTING.

An Improvement Scheme for Side Streets.

The staff of the Lighting Department of the Glasgow Corporation had their annual social meeting last Wednesday, under the presidency of Mr. S. B. Langlands, the Inspector of Lighting. The gathering was interesting from the fact that the Convener of the Watching and Lighting Committee (Mr. Bruce Murray) delivered an address in which he dealt with the work of the department, and indicated many of the improvements effected in the lighting of the city in recent years.

In the course of his remarks, the Convener said that about a dozen years ago he carried a motion in the Council appointing a Committee to deal with the subject of lighting, and after careful investigation of various methods of lighting by gas and electricity; and after the inspection of several cities, the Council adopted the recommendations of the Committee. Notwithstanding all that had been done, insufficient light was still the cause of much complaint by residents in side streets and tenement houses, and it should not be disregarded. But the advance then made had the effect of educating both the Corporation and the public as to the value and importance of good lighting on up-to-date and scientific methods, and led to the trial and adoption of many improvements. It also led to what was no less important—the formation of a staff better equipped as regards knowledge, training, and laboratory apparatus to deal with lighting in a more scientific manner than had previously been deemed necessary.

At the present moment the lighting of the main thoroughfares was satisfactory, and compared favourably with other cities in this country, although perhaps not quite up to the illumination of many of those abroad. The same, however, could not be said of the side streets, stairs, and courts, in regard to which the time appeared ripe for considerable improvements, which he might say were in contemplation, and which he should like to see inaugurated without further loss of time. All improvements, of course, involved both expenditure and the concurrence of the proprietors. Difficulties in this respect would be removed by the Act of 1914, which would come into operation in 1922, whereby the whole provision of lighting, not only as regards public streets, but stairs, side streets, and courts, would be under the absolute control of the Corporation—the cost of the whole system being borne equally by owners and occupiers of property.

But 1922 was a long way off; and it seemed hard on citizens, if not actually unbusinesslike, that these much-needed requirements should be delayed until then. The cause of this delay was mainly a matter of pecuniary adjustment, which, judging from the successful negotiations already referred to, should not present insuperable difficulties. Better lighting was in the interests of houseowners and tenants, and of the citizens generally. There were now great possibilities in the way of providing this, both by electricity and gas, with comparatively little cost; and he felt sure that, with a definite scheme before them, the houseowners, the tenants, and the Corporation would take a broad and reasonable view of the whole question, and would, by co-operation and possibly mutual concessions, place the Lighting Committee in a position to give the citizens without much further delay the full benefits to be expected under the new Act.

LONDON COAL SUPPLY AND FREIGHTS.

South Metropolitan Gas Company on the Position.

In a leaflet dated last Wednesday, and bearing the signature of the Secretary (Mr. F. M'Leod), the South Metropolitan Gas Company, under the heading of "Alarming Outlook in Regard to London's Coal Supply," state that they desire to bring to the notice of their customers the following exceptional circumstances.

The Company obtains practically the whole of its coal supply from Durham, and charters ships to bring it to London at a cost in normal times of about 3s. per ton—a figure which provides a good profit to the shipowner. It cannot, however, be expected that, during the war, ships can be run with profit at such a figure. For one thing, under the Admiralty regulations they are only allowed to travel during the hours of daylight, which means that the earning capacity of a ship is very largely reduced. Again, by reason of the risk from mines, the seamen are receiving higher wages. There is also the increased cost of insurance against war risks. If the figure of 3s. per ton for freight be increased to 5s. per ton, an ample margin would be allowed for all these costs, and still yield a handsome return to the shipowner.

Owing to the requirements of the navy, the Admiralty has requisitioned a large proportion of the vessels employed in carrying coal for this and other gas companies. One result of this has been that no less than 13s. 6d. per ton has been paid for freight of coal from the North of England to London. To compensate in some measure for the shortage of vessels, it has been suggested that the alien ships interned at our various ports should be available for chartering in place of those commandeered by the Admiralty. This arrangement has now been made; but, instead of fixing a fair rate at which these vessels could be chartered, it has been decided by the Government that the price should be fixed at the market rate, no matter however inflated or artificial this may be. The result of this action is that, for every ton of coal brought to London by sea, the London user has to pay an additional rate of some 10s. per ton over and above normal cost, or between 8s. and 9s. beyond what would be reasonable, or even liberal, taking into account all the present exceptional circumstances.

Such a figure as that quoted would be equivalent to an extra charge for gas of 8d. or 9d. per 1000 cubic feet—a tax which it is quite unfair to impose on the people of London.

The South Metropolitan Gas Company has made all representations possible to the authorities, and now ask the help of its customers, in the hope that they may bring pressure to bear upon their representatives in Parliament that such a serious grievance should be remedied.

The Government has taken over, and is working, the railways; and although these are badly congested, the statutory charges for handling goods by rail have not been increased. The Government has already fixed a minimum wage for the workers in coal mines, and also provided machinery for fixing fair wages for many trades. It does not seem unreasonable to ask that they should fix a fair price for chartering such ships as may be temporarily provided in place of those that have been commandeered by them.

In an article in the "Daily Chronicle," under the heading of "The Shipping Tax," Mr. L. G. Chiozza-Money refers to the South Metropolitan Gas Company's circular, on which he makes the following remarks:—

"The Gas Company make the suggestion that the Government should fix a fair price for chartering the alien ships which have been interned at our various ports, instead of fixing the price at the artificially inflated market rate. I hope that the public will not be led astray by the representations of the shipowners as to the manipulation of wheat. It is perfectly true that the freight factor is not the only factor in governing price. It is, however, a very important factor, and it happens to be one which we can very easily control. Whatever else the Government may do, therefore—and there are other things that might be done—I hope they will very sternly and immediately give their attention to what I have with reason called the 'shipping tax.' The case of coal is a very simple one; and it enables the man in the street to form an accurate judgment upon the more obscure case of wheat."

BYE-PRODUCTS RECOVERY IN JAPAN.

Application for Government Assistance.

In the article on "The War and the Gas Industry of Japan" which appeared in the "JOURNAL" for the 22nd ult. (p. 681), it was mentioned that the Imperial Gas Association were considering the best method of establishing in Japan a large central bye-products factory, to compensate for the shortage of chemicals caused by the European War, and that they were trying to impress upon the Central Government the importance of the undertaking, and endeavouring to obtain their assistance. The last number to hand of the "Journal" of the Association contains the text of the proposal, which has been sent by the President (Dr. T. Takamatsu) to the Prime Minister, as well as to the Ministers of Agriculture and Commerce, Army, Navy, and Finance. In the course of it are the following observations.

There are many ways in which national destiny and wealth can be promoted; and we recognize that such promotion is vitally necessary. But, in view of the present conditions, above everything else for the furthering of the national welfare must come the promotion of the general industry as well as the chemical industry. During the past few years, our industry has made great progress and development; but it is a conspicuous defect that the chemical branch is still in an incipient stage. It cannot be denied that Germany owes much of her present commercial influence throughout the world to the rapid growth of her chemical industry during the past forty years, though, of course, she has many other sources of wealth. The increased yearly importation of these chemicals into Japan points only too well to the lack of our development in this line; and the present inconvenience caused by their lack shows clearly the urgent necessity for the manufacture in this country of these indispensable commodities.

Broadly speaking, the carbonization of coal is employed both in the manufacture of gas and coke and in the development of the chemical industry; and coal tar, the principal bye-product, plays a most important part. Its utilization is of great importance to us at present. To-day coal-tar bye-products recovery industries are operated in Tokyo, Osaka, and Miike; but they are still in such an undeveloped stage that they are unable to manufacture such delicate commodities as valuable explosives, scents, dyestuffs, &c. Therefore, in order to promote the industry in this country, it is important that such articles should be produced there.

To start the business on a small scale, leaving it to the discretion of the local companies who have but a small output of coal tar, would be highly unprofitable; so we suggest that the tar, or its crude products, should be collected in a suitable manner throughout the country, and the business be carried on in one large enterprise. The present annual production of coal tar is about 300,000 *koku*, or nearly 60,000 tons; that from the gas companies being about 170,000 *koku*, and from the coke factories about 130,000 *koku*. Though these tars are not the same in quality, owing to the difference of coal, temperature of the retort or oven, and method of operation, yet we can obtain, by rough calculation, the following products, in the given ratio, by distillation, re-distillation, and refining.

Benzol	230 tons	Creosote	43,000 *koku*
Toluol	140 ,,	Fuel oil	35,000 ,,
Carbolic acid	200 ,,	Anthracene	200 tons
Cresol	700 ,,	Pitch	38,000 ,,
Refined naphthalene	3400 ,,		

The above products can be utilized not only in various suitable requirements, because of their peculiar qualities, but can be further utilized in the manufacture of various medical and industrial drugs, explosives, scents, dyestuffs, &c. It will be readily seen from this that, if the bye-products recovery industry be further developed, not only can we prevent the ever-increasing importation of these commodities, but can also contribute in no small measure towards the national wealth and towards military supplies. The development of the bye-products recovery industry has a great bearing upon the chemical industry of the nation.

We have, however, great apprehension as to the success of such a large undertaking if conducted by private capital or by individuals, as, the manufacture being carried on in one place, it would necessitate a

great expenditure for freight and in other ways, which would hamper to a great extent the profitable management of such a concern.

This being the case, we think it incumbent upon the Government to give some protection and assistance in the establishment of such an indispensable and initiatory industry, which will in its very nature enhance to so great an extent the national destiny.

Because of the present alarming shortage of chemicals, the Association deem the moment a propitious one for presenting to your Excellency for consideration the urgent need of promoting the chemical industry of this country, and earnestly requesting the support and generous assistance in its development.

We learn from the "Journal" of the Association that, though no official answer had been sent to the proposal at the date of publication (the 15th ult.), the Premier and the Ministers of Agriculture and Commerce and the Navy are in favour of it. This being the case, a conference of representatives of all the gas companies and coke-works was convened by the Association to consider the question of the organization of a bye-products factory; and it was held in Tokyo. Thirty representatives, from thirty-eight companies, were present; and the result of the discussion was the unanimous appointment of a Committee to investigate the subject further. It is stated that since the proposal was sent in, the nation has been looking forward to the success of the scheme, which has been taken up favourably both by the Government and the nation.

Dealing with the question, the Editor of the "Journal" (Mr. S. Inubushi) said: "Useless to state that the furthering of the gas bye-products recovery industry will have a great bearing upon the management of our gas companies. They have recognized for many years past the need of such an undertaking; but as most of them are limited in their manufacturing and managing capacities, they cannot conduct such a huge business with any degree of economy or with financial success. This state of affairs has been the source of great regret to our gas men; and accordingly the present efforts have been made in order speedily to rectify the defect. In fact, to leave the gas industry as it is will neither tend to the further development of the business nor will it contribute towards the national wealth. The proposition, brought forward in answer to the present need, is a timely measure through which both the gas industry and the national lack of chemical products will be met. We therefore earnestly desire its success."

GAS PROGRESS IN THE UNITED STATES.

At a Convention of the Investment Bankers' Association of America, held in Philadelphia, Mr. RUFUS C. DAWES, of Chicago, delivered an address on "The Modern Gas Company as a Security for Bonds," in the course of which he referred as follows to the growth of the gas industry in the United States.

As early as 1835 there were at least six gas plants in the largest cities of the United States, and the business may be considered as well established at that time. The oldest tradition of the business is to maintain an uninterrupted supply of gas. It was a proud advertisement made by the Consolidated Gas Company that "New York City's gas supply has never failed in eighty-seven years." But it is substantially true of all gas companies. This determination to establish a dependable service has had no small part in the development of the business; for the gas business has, from the start, had many things to contend against. The inventive genius of mankind has exhausted itself in an effort to supply some substitute for the service it has rendered; but, in spite of many obstacles, and contrary to many fears, the gas industry has steadily grown. The obstacles have been overcome. The fears have subsided. The industry has entered a new era, and has more than doubled its volume of business in the last decade. Invention now works for, not against, its future growth. The price at which its product has been sold has steadily declined. In New York City, for instance, the price in 1826 was $10; in 1846, $6; in 1866, $3 50; in 1886, $1.25; in 1906, $0.80. Each reduction in the selling price of gas has opened-up new fields for its use.

Our fuel carries heat units in a form more available for use than any of its competitors. Whenever a new field is invaded, the genius of inventors perfects the methods of burning gas; and the demand for such inventions has only recently been felt. The response is most encouraging, and the double effect of lower prices and more efficient burners has already been apparent, and supports the strongest confidence for further success in the heating field. Herein lies our future; and we are not so far as some have supposed from our great goal—the use of gas exclusively for domestic heating.

Bonds issued by modern gas companies are secured by a natural monopoly in the sense that their property is the only one capable of supplying exactly the same service. Moreover, under present legal adjustments, which provide for regulation and control with due regard to the protection of money invested, such property can never be duplicated or abandoned, but must be devoted to supplying this service, exclusively and perpetually. Yet these companies are engaged in the greatest of competitions—the competition of fuels. At least we have at last learned to conduct our business in this conviction; and we do believe that we can deliver the elusive and highly prized heat units in safer, cheaper, and more available form than our competitors, for an annually increasing number of purposes.

In support of our confidence, I may submit some statistics compiled by Mr. John W. Lansley, from a United States Government report relating to the gas industry. These figures are the best available, and appear to be substantially correct:

Year.	Number of Plants.	Capital Employed.	Annual Product.
1850	30	$6,674,000	$1,921,746
1890	742	258,772,000	56,987,000
1900	877	567,001,000	75,717,000
1910	1,296	915,537,000	166,814,000

Between 1890 and 1900 the increase in capital appears, from these statistics, to be 119 per cent.; while the increase in annual gross income appears to have been only 33 per cent. Between 1900 and 1910, on the contrary, capital appears to have increased 60 per cent. and the annual gross income 120 per cent. The increase in the amount of capital between 1890 and 1900 was about the same as between 1900 and 1910; but the increase in income between 1900 and 1910 was five times that between 1890 and 1900. This increase in gross annual income was brought about by a reduction of 32 per cent. in the price at which the product was sold. In other words, a gradual reduction of 32 per cent. in the price of the product resulted in ten years in an increase of 120 per cent. in the gross annual revenue of an industry eighty years old, and necessitated an increase of only 60 per cent. in capitalization.

The most interesting incident in this extraordinary accomplishment is the increase in the consumption of gas for fuel purposes. It is difficult to determine these proportions accurately; but the United States Geological Survey gives figures from which it may be estimated that in 1900 the proportion of gas used for fuel was about 20 per cent. of the total, and in 1910 about 50 per cent. From these conditions and these tendencies may it not be safely predicted that the future of the gas industry is secured?

As a basis for bonds, the modern gas company offers, then, these conditions: A stable income for the supply of a public necessity, an increasing income, physical property exceptionally high with relation to income and permanently devoted to public service, moderate and not extortionate profits, a long record, excelled by none, and a present condition of growth never before experienced.

AIR RAIDS AND THE LIGHTING OF LONDON.

Dangers of Isolated Plants.

In view of a possible raid by Zeppelins upon London, the question of the effect on the lighting installations is being discussed; and a former Manager of one of them has given his views on the subject to a "Globe" reporter. They are as follows:

"In regard to gas, London is supplied from a number of works. These formerly isolated works are now linked-up with each other and with the great works at Beckton; so that if one were damaged by bombs the others would come to its aid and supply the network of mains all the same. The injury or even the destruction of one of the smaller gas-works would thus not seriously interfere with London's supply. In electrical matters London is unfortunately not so well off. It is supplied from a number of electric light stations, which are mostly quite independent of each other. They have no auxiliary supply such as the gas companies have at Beckton. Hence the shutting-down of one of the stations would in many cases deprive the whole district it feeds of light *pro tem.*"

Asked if it was not possible to link-up the electric stations in the same way as the gas-works, the gentleman interviewed said: "Certainly; and one or two of the stations—especially those belonging to one company or to allied companies—are in a position to help each other in case of trouble. But the great majority of the stations are isolated and unconnected with each other. The reason for this is that London's electrical supply is in the hands of an enormous number of separate authorities. Altogether, I believe, there are over 50 separate authorities in and around London. They have no connection with each other; and as some are local authorities and some are companies, they have never co-operated with each other. In fact, the law, until recently, prevented them doing so. There is a further drawback, and that is that the types of plant they use are often different, so that unless special arrangements are made, it would not be possible in many cases for one station to help another. The London County Council have realized this, and have several times made proposals for linking-up all the stations in London just as the gas-works are linked-up; but the mutual jealousies of the Borough Councils, the Companies, and the County Council have hitherto prevented any mutual arrangement being arrived at. The present Council scheme is a much less drastic measure than the former proposals. The Council have profited by their experience, and in the Bill now before Parliament they only propose a voluntary system of linking-up, and to furnish an auxiliary supply only to those concerns that want it, from several large new stations put up in different places. If there had been such a system in force the other day as the Council now propose, the breakdown of the trams would have been a very trifling affair. Of course, it would have taken a few minutes to connect-up the auxiliary supply, but this would not take long. This has already been proved in other places. I think the scheme is likely to come to fruition."

A HUNDRED YEARS AGO.

In the bound volumes of "The Times" in the Newspaper Room at the British Museum, an amusing correspondence on "Gas Lights" figures in the issue for January, 1815—a hundred years ago. Various correspondents, signing themselves "A. C.," "The Chemist's Friend," "Verax," &c., wrote pointing out the grave danger of the new illuminant; and equally grave and anxious writers hastened to re-assure the citizens.

"Investigator" points out that "the gas light, having no wick, requires no snuffing or trimming." There are no sparks; and it is "extinguished simply by turning a cock." "Hydrogeno" adopts a more facetious view: "Your correspondent 'A. C.' is certainly no chemist. He looks rather more like a whale, and, notwithstanding all his assertions to the contrary, smells very strongly of oil. . . . He gravely states that hydrogen gas communicating with the atmospheric air, will, if a light be applied to it, ignite and burn. To be sure it will, and with great beauty and splendour, too. If it did not, the Gas Light Company

would be 'blown up' indeed. I am equally assured that if an opening takes place in the gasometer, and a light be applied to the aperture, it will burn, and will scorch any man who stands opposite, just as he might be scorched in five hundred other ways—for instance, by living over an oil-shop when it takes fire." Finally, we have the inevitable "Friend to Truth." He is, at first, less frivolous. "Gasometers," he reminds us, "are only situated at the works of the company. They are under the immediate inspection of the most intelligent of their men; and no light is ever required to be used in them." Consequently, "the public may sleep sound in their beds—and much sounder," he hints (for he, too, has a sense of humour), "as the light will be so clear that midnight depredations will be less frequent." Knowing that it is practical proof that best clinches an argument among Britons, he concludes: "I have heard it remarked that some shopkeepers in Bishopsgate have said that if any person would give them oil to burn for nothing, they would yet prefer to pay for the use of the gas lights."

This seems to end the discussion. Either the critics of gas did not venture to reply, or the Editor closed his columns to them. It is true that two months later Napoleon returned from Elba; and in the excitement of those pre-Waterloo days the papers published little except more or less reliable war news from the Continent. But this curious discussion during the few months' peace between the Peninsula War and the fighting in Flanders seems original enough to merit centenary notice.

Profits of a Norwegian Nitrogen Company.—The Société Norvegienne de l'Azote reports gross profits of £468,000 for 1913-14, as compared with £442,000 in 1912-1913, and net profits of £316,000 and £287,000 in the two years respectively. It had been proposed to pay dividends of 8 per cent. on the preference capital and 6 per cent. on the ordinary shares; but these recommendations are not to be carried into effect. The Company had concluded a loan with the Société des Annuités, of which two-thirds had been completed on the outbreak of the war. At present the work of extending the plant at Rjukan is at a standstill, owing particularly to the impossibility of securing the delivery of machinery on order, in consequence of the war.

Gas and Electric Light Estimates at Colwyn Bay.—The lighting of a new road has been under consideration by a Committee of the Colwyn Bay Urban District Council, who, having gone into reports by the Electrical Engineer and the Gas Engineer, recommended the adoption of gas. The Council, however, agreed to a compromise, by dividing up the lighting, though even the proposer of this solution admitted that "he would prefer the gas-lighting system for the town generally." Apart from considerations of the cost of installation, in the original scheme the annual charge for current and maintenance was given as £147, with a total illuminating power of 6400 candles, as against a yearly cost for gas and maintenance of £156, for clusters of incandescent burners giving a total light of 11,520 candles.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

After the Cowdenbeath Town Council had passed a resolution to adopt the Burghs Gas Supply (Scotland) Act a remonstrance, signed by 22 ratepayers, was lodged, and, as a consequence, a poll of the householders had to be taken on the question of the adoption of the Act. The Council wish to acquire the gas-works. On the other hand, the Gas Company are applying for a Provisional Order [*ante*, p. 135] to give them statutory powers in the burgh and surrounding district. The poll was taken last Thursday, with the result that the adoption of the Act was confirmed by 629 votes to 74.

Some months ago the city authorities of Aberdeen greatly reduced the lighting. With the view of ascertaining the effect as seen from the sea, the Sub-Committee of the Lighting and Fires Committee of the Town Council, accompanied by Colonel Haines, Major Minto, and Chief Constable Anderson, carried out a minute inspection last Tuesday. They visited Girdleness and Bridge of Don, and observations revealed the fact that there were several places throughout the city conspicuously lit up—the reflection being very marked; while the general lighting of the city sent up a considerable glare, which could unmistakably be seen from far out at sea. They were firmly of the opinion that the lighting throughout the city must be still very considerably reduced, especially in regard to the windows of private houses. It is to be insisted that every window must be so darkened as to permit of no reflection whatever; and this will apply to all cases, whether facing inland or seaward. If householders do not abide by this decision, stringent measures will be taken, as the military authorities are determined that the lighting shall be reduced to the utmost minimum.

At the monthly meeting of the Greenock Town Council on Tuesday, a discussion took place with regard to the quality of the gas, and a suggestion was made that an expert should be appointed to ascertain whether the works could not bring it up to 17-candle power.

In the "Notes" in the last number of the "JOURNAL," further reference was made to the dissatisfaction shown by members of the electrical trade in Edinburgh to the proposal of the Corporation to open show-rooms throughout the city and let electrical appliances on hire. At the meeting of the Town Council last Tuesday, they sat in committee to consider the clauses bearing upon this matter in the Provisional Order, with certain suggested alterations, together with a further representation by the trade. The Convener of the Electric Lighting Committee (Mr. Stevenson) moved approval of the clauses as altered; but an amendment was submitted that they be deleted from the Order, and this was carried by 20 votes to 13.

A correspondent, who signs his letter "Fair Trading," wrote as follows to one of the local papers on the subject dealt with in the preceding paragraph: "Why don't the plumbers and gas-fitters of Edinburgh, Musselburgh, and Dalkeith combine, and do as the

1914—A Retrospect.

The "Journal of Gas Lighting," in its retrospect of 1914, says:

"Another advance has been invention to secure the MORE Silent Operation of Gas Fires."

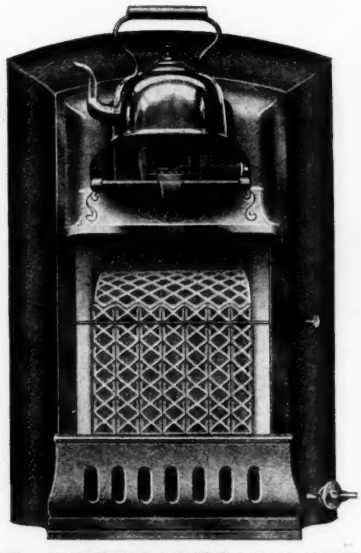
Eliminate the word "MORE"—and the statement is applicable only to the

WILSON "SOLA" GAS FIRES.

WILSON'S are the Inventors and Originators of the

REALLY SILENT GAS FIRE.

WITHOUT NOISE AND :: ::
WITH KEEN HOT FLAMES.



The "REGIS" SILENT GAS FIRE,
Fitted with Concealable Boiling Burner.
(Patent No. 18,638).

WILSONS & MATHIESONS, LTD.,
Carlton Works, Armley, Leeds.

London Show-Rooms:
76, Queen Street,
Cheapside, E.C.

electric contractors of Edinburgh have done? I think it is unfair of the companies to fit up gas fires and cookers free. Those who require gas fires and cookers are quite able to pay for same. If this were done, the companies would then be able to reduce the price of gas, and the poorer class would reap the benefit. If these companies are to be contractors, let them charge the same rates as contractors."

A meeting of the Tala Water District Committee of the Midlothian County Council was held in Edinburgh on Wednesday, when, on the recommendation of the Committee of Management of the Gorebridge Special Water District, they adopted the suggestions contained in a report by Mr. G. Somervel Carfrae for the introduction of an additional water supply to the special district; and the Committee of Management were authorized to obtain estimates and have the work proceeded with as soon as possible.

Special meetings of the Forth Navigation Commissioners and the Governors of the Stirling Educational Trust have been held to consider how their interests will be affected by the Glasgow water scheme, which proposes to impound the waters of the River Turk. The Town Clerk of Glasgow in a letter signified the Corporation's willingness to discharge 5 million gallons of compensation water daily from Loch Vennacher into the River Teith in addition to the 42 million gallons given under the present arrangement, or a greater quantity if their expert reported that one-third of the available rainfall would amount to more than 5 million gallons. Both the Commissioners and the Educational Trust agreed to follow the lead of the Stirling Town Council and accept Glasgow's proposals, provided the covering clauses in the Bill are satisfactorily adjusted.

Wath-upon-Dearne Water-Works Extensions.—It was recorded in the "JOURNAL" for the 1st ult. that the water-works extensions which were being carried out by the Wath-upon-Dearne Urban District Council, under the supervision of their Engineer and Surveyor (Mr. J. H. Drew), at a cost of £12,000 were approaching completion. They were recently opened by the Chairman of the Water Committee (Councillor Godber). The new pumping plant is capable of forcing water to the new reservoirs at the rate of 25,000 gallons an hour; while the storage capacity of the new and old reservoirs is 900,000 gallons. About three miles of new mains have been laid.

Reservoir Damaged in a Gale.—It was reported by the Surveyor (Mr. J. J. Quirk) to the Brynmawr Urban District Council that, during the heavy gale on the night of the 15th inst., considerable damage was done at the reservoir. Pending repairs which were required to the dam, the reservoir had not been allowed to fill up to the highest possible level, for fear of damage in time of storm. On this occasion, however, the water seemed to have filled up rapidly; and a portion of the temporary bank at the west end of the reservoir was swept away, and a large quantity of water escaped down the mountain side. The culvert at Cwmpont Melyn was blocked; and the rush of water tore up the road for some distance.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 25.

There has been no change to report in the London tar products market during the past week. Orders continue to be placed for tar and pitch for road purposes next season at reasonable prices.

Sulphate of ammonia remains in a strong position, and there appears to be a shortage of material to meet the spring requirements. For February-March the price is £12 7s. 6d. to £12 10s. net per ton in buyers' bags, *ex* makers' works, for 25 per cent. quality; and for the second half of this year, £12 has been paid on the same terms as above.

Tar Products in the Provinces.

Jan. 25.

There is no material alteration in the markets for tar products. Benzols remain in the same position, and there is not much new inquiry. There has been a good demand for solvent naphtha during the past week, and the price has improved somewhat. Heavy naphthas are also steady. In crude carbolic, business is reported from 2s. 10d. to 3s. per gallon, according to position and time of delivery. The market for creosote is fairly steady, though there appears to be plenty offering.

The average values during the week were: Value of liquid products in one ton of tar, 17s. to 18s. 6d. Benzol, 90 per cent., naked, North, 8¾d. to 9¼d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. to 2s. 4d. Crude naphtha, in bulk, North, 5¼d. to 5⅜d. Solvent naphtha, naked, North, 1s. to 1s. 1d. Heavy naphtha, naked, North, 11d. to 1s. Creosote, in bulk, North, 3⅜d. to 3 7/16d. Heavy oils, in bulk, 4d. to 4⅛d. Carbolic acid, casks included, 60 per cent., East and West coasts, 2s. 10d. to 3s. Naphthalene, £6 to £11; salts, 65s., bags included. Anthracene, "A" quality, 2d. per unit; "B," nominally ¾d.

Sulphate of Ammonia.

LIVERPOOL, *Jan.* 23.

Throughout the week there has been no slackening in the demand for sulphate, and all available supplies have continued to be keenly competed for at ever-increasing prices. At the close, the tendency is still upwards, and the nearest values are £13 10s. per ton f.o.b. Hull, £13 12s. 6d. per ton f.o.b. Liverpool, and £13 15s. per ton f.o.b. Leith, for January delivery. In the forward position producers are again firmer in their views, and it has transpired that £13 15s. per ton f.o.b. Liverpool has been paid for February-March-April delivery, while oil makers are now quoting £14 f.o.b. Leith over this period.

R. & J. DEMPSTER, Ld., Gas Plant Works, MANCHESTER.

London Office: 165, Gresham House, Old Broad Street, E.C.

Nitrate of Soda.

This market is very steady at 10s. 3d. per cwt. for ordinary and 10s. 6d. for refined quality on spot.

Sulphate of Ammonia.

From another source it is reported that the market has remained very firm throughout the past week, and the price has improved at almost every port. Outside London, makes are quoted at £12 10s. to £12 12s. 6d.; Hull, £13 5s.; Liverpool, £13 5s. to £13 7s. 6d.; Leith, £13 7s. 6d.; Middlesbrough, £13 5s. to £13 7s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is rather brisker, with a little ease in freights. They, however, continue high enough to limit export business, though keen demand in many parts forces trade even under record costs abroad. In the steam coal trade, best Northumbrians are from 13s. 7d. to 13s. 10½d. per ton f.o.b. according to position; second-class steams are about 11s. to 11s. 9d. per ton; and steam smalls are 8s. to 9s. 3d. per ton, with a rather better demand. Shipments of steam coals are a little better, and some contracts are in course of negotation. In the gas coal trade, the home demand is good; and for France and Italy the inquiry is also full. But gas coal at Genoa now costs about 47s. to 47s. 6d. per ton; and there is a disposition to postpone contracts when quotations such as these are enforced by the high freights. Best Durham gas coal is quoted from 12s. 3d. to 12s. 4½d. per ton f.o.b.; second-class kinds are round about 11s. to 11s. 3d. per ton; and "Wear Specials" are 12s. 10d. to 13s. per ton f.o.b., with a steady demand. There is little doing in contracting for gas coals just at present, though the time is near when some important Swedish gas coal sales are usually made. In the coke trade, the tone is fairly steady. Gas coke is in rather fuller demand. Exports are good in the circumstances; and on Tyneside the quotation is from 11s. 6d. to 12s. 4d. per ton f.o.b. for good gas coke for export.

Tarless Fuel Syndicate.—At an adjourned meeting last week of the Tarless Fuel Syndicate, Limited, a report was presented dealing with negotiations which had been opened for the granting of licences to use their process on a royalty basis. This stated that colliery owners had been convinced of the soundness of the system; and during the next twelve months something like £70,000 should be spent in the erection of tarless fuel plants. It was estimated by the Chairman (Mr. O. J. Parker) that the plants at present in hand should yield sufficient to pay, in royalties alone, a dividend of 10 per cent. upon the present capital of the Syndicate, with a prospect of this figure being largely exceeded. The business had been worked as economically as possible; and there was, in his opinion, an excellent prospect.

Loss of a Gas-Coal Steamer.—The Gas Light and Coke Company had the misfortune to lose, early last Friday morning, their steam-collier "Vauxhall," which foundered in the North Sea, off Sheringham, after striking a submerged wreck. All hands were saved.

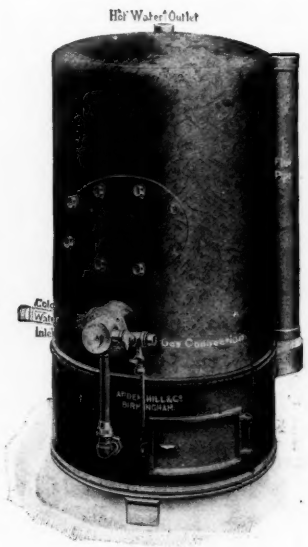
Water Rights in Tasmania.—The Tasmanian Government have prepared a very important Bill on the subject of water supply. Its object is to settle the question of riparian rights, and to put on a clear and definite basis other matters connected with the use of the water of the State. It is proposed to give the holders of land on the banks of any stream or river the right to raise as much water as may be required for domestic purposes and for watering stock, and also for irrigating three acres of land. Apart from this, all the water is to be vested in the Crown, and anyone taking it must obtain a licence to do so. The Bill will avoid the complications arising under the present law.

Doncaster Rural Water Supply.—An application by the Doncaster Rural District Council to the Local Government Board for sanction to a loan of £7100, for works of water supply in the parish of Adwick-le-Street, was the subject of a recent inquiry conducted by Mr. A. W. Brightmore, M.Inst.C.E. Mr. D. Balfour, jun., the Engineer to the Council, gave evidence with regard to the scheme, and said provision would be made for a population of 4000 to receive a minimum supply of 80,000 gallons per day. The reservoir would have a storage capacity of nearly half-a-million gallons. Dr. A. B. Dunne, the Medical Officer of Heath, emphasized the necessity for an efficient supply in the interests of public health.

The Colliery Water Dispute at Nuneaton.—The Nuneaton water dispute, which has proceeded for some considerable time between Stanley Bros., Limited, and the Nuneaton Corporation, and to which reference has been made in the "JOURNAL," is now the subject of an official statement issued by the Corporation. It will be remembered that Stanley Bros., colliery proprietors, of Nuneaton and Bedworth, brought an action against the Corporation to recover a sum of money alleged to have been overpaid in respect of water supplied, and the matter subsequently went to arbitration. From the point of view of the Council, it now stands as follows: The Council have incurred law costs to the extent of about £1100; but, on the other hand, Messrs. Stanley's claim to the sum of £2314 has been defeated. Further, if the compromise suggested by the Council had been agreed to, it would have meant a payment of £700 in cash and a liability to supply Messrs. Stanley with 10 million gallons of water per annum, at 3½d. or 2d. (as the case may be) per 1000 gallons, as against the sum which they have paid for all the water they have used throughout—viz., 8d. per 1000 gallons, less 10 per cent. The contention which the Council have made throughout the proceedings, that the demand for such large quantities of water by Messrs. Stanley was due to the inefficiency of their pumping main, and not to shortage of their own supply, is, they submit, conclusively proved by the facts set forth in their statement. The difference between the 3½d., at which the Council offered the water, and the 8d. paid by Messrs. Stanley since the offer, amounts roughly to £600 in favour of the Council.

Hot-Water Supply for Barracks, Hospitals, &c.

CAN ALWAYS BE RELIED UPON, IF A



"ZENITH"

BOILER

(Combined Gas Heater and Storage Tank)

IS INSTALLED.

HIGHEST POSSIBLE EFFICIENCY,
LOWEST POSSIBLE GAS CONSUMPTION
are ensured by the Patent
SELF-ACTING GAS VALVE.

MADE IN THREE SIZES—10, 20, and 40 GALLONS.

ARDEN HILL & CO., ACME WORKS, BIRMINGHAM.

Gas Matters at West Bromwich.

A criticism of the gas supply which was made at the annual meeting of the West Bromwich Tradesmen's Association, resulted in a representative of the "Midland Chronicle" paying a visit, on the invitation of the Gas Engineer (Mr. W. H. Johns), to the Dartmouth Street Depôt, to witness an exhibition of different methods of burning gas. What he saw is thus recorded: "It was clear from these tests that the Gas Department of West Bromwich are using a type of burner—which burners can be obtained free on application at the depôt—which gives a perfectly satisfactory light. Our representative saw a demonstration between lighting with the old burner and with the new; and the improvement was most remarkable. It is quite evident that these new and up-to-date burners are more efficient and economical than the old ones; and for those who do not use mantles, they give a light that would remove all cause for complaint. There is no doubt that with the old type of burner there is much gas wasted; this being quite obvious during the demonstration." On another matter, the same paper says: "To remove a wrong impression that has got about the town, we are asked officially to state that, as the result of the introduction of the automatic street lighting system, not a single employee of the Gas Department has been dismissed. Those whose services are not required for lighting the street-lamps have been given other jobs at the works. Three have, however, left on their own account; they having secured other situations." In the course of an interview, Mr. Brockhouse (the Chairman of the Gas Committee) said the Committee had shown the men who had been affected by the introduction of the new gas making and distributing systems every consideration; and he hoped to be able to make a public statement at the next meeting of the Council, to clear the air somewhat as to the position of affairs.

Meter-Testing in Canada.—A Canadian Blue Book which has lately been issued furnishes particulars in regard to the testing of gas-meters in the year ended March 31, 1914. The number presented for verification was 88,133, of which 23,641 were correct, while 16,253 were fast and 47,400 slow within the legal limit. Altogether 87,295 meters were verified and 838 rejected.

The Electricity Schemes for London.—The Electrical Engineer of the St. Pancras Borough Council has reported on the electricity scheme of the London County Council, which he declares "presents the greatest display of inefficiency to guard public interests ever committed to print." With respect to the Companies' rival Bill, he says: "This Bill is a striking contrast to the London County Council Bill in clearness of intent and brevity of description, and is indicative of a businesslike conception of all the circumstances surrounding the complex questions dealt with. Its object is the unification of the supply to London—a measure forced on by the persistence of the London County Council. It seeks to resolve into one company ten of the most important Companies supplying London."

Gas Workers at the Front.

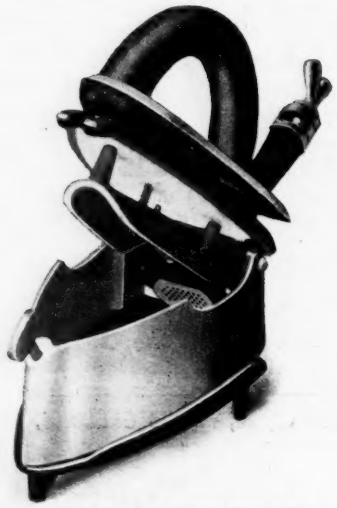
Under the heading "Technical Progress," the following remarks appeared in the "Ironmonger" last Saturday: "The manhood of the gas industry, whether employed in the manufacturing or the distributing branches, cannot be reproached with hanging-back from the duty of national defence. A large number of Fleet and Army reservists is ordinarily employed in the less skilled departments of gas undertakings; and these, of course, went off at the first mobilization. They have been followed by a very considerable proportion of enlisted men, encouraged, doubtless, by the generous promises of reinstatement and provision for dependants offered by the undertakings, without exception. Nor were these men in many cases without knowledge of arms, for numerous gas-works have long had rifle clubs and ranges of their own. Quite recently, successful recruiting meetings have been held at various important gas-works. As a result, some gas undertakings now find one or more of their departments seriously short-handed. Outdoors the assistance of the trade is being called upon to do installation work; for though there is some slackness in the demand for additional household gas appliances, due to the reluctance of people to launch out upon new expenditure, there is much that must be done. The services of gas-fitting contractors are consequently in demand, especially as workmen in the employ of private fitters are generally older than companies' men. The present emergency offers a new lease of usefulness to men who are past the military age. We shall not hear the 'too old at forty' complaint for a season. In point of fact there was never much substance in it; and the public, who were invited to weep over the hard case of the prematurely superannuated workman, were not made aware of the true reason for what could so easily be given an appearance of tyrannical action. It was frequently drink. Workers in gas must obviously have their full senses about them at all times. If the cases of 'drunkenness in charge' at any police court are examined, the offender will in the vast majority be found to be a man of ripe age. Temptation to drink is peculiarly strong in gas-fitters; and the evil constitutes one of the most troublesome of plagues alike of the gas office and the ironmonger or master plumber."

Mallow Gas Undertaking.—In a report to the Mallow Urban Council on the accounts of the gas undertaking, Mr. R. J. Baker (Local Government Board Auditor) states that from Feb. 14, 1913 (the date of acquisition), to March 31, 1914, 6,088,800 cubic feet of gas were produced, with a consumption of 618 tons of coal, resulting in a yield of 9852 cubic feet per ton. He added that better results were now being obtained, as the figures some weeks ago stood as high as 13,800 cubic feet. The Auditor submitted various suggestions as to the methods of keeping the accounts, expressed satisfaction with the result of the first year's working of the undertaking under the Council, and mentioned that the current year's accounts showed very considerable improvement. He paid a tribute to Mr. P. J. Philpott (the Gas Manager) for the assistance given him.

A Perfect Heating Gas Iron.

Clark's "FAIRY" Gas Iron is designed and constructed on an entirely new principle, which produces the highest heating efficiency at a minimum gas consumption. Fitted with ebony-finished wood handle, copper hand shield, nickel-plated sides and base, it is thoroughly serviceable and of pleasing appearance. Perfect Combustion. No Smell.

Adjustable to all Pressures of Town's Gas.
Thorough and even heating right to the point.



The "FAIRY" Gas Iron showing Hinged Top.

List Price 6/6.

May we send you sample—it only requires testing to be adopted.

Clark's Syphon Stove Co., Ltd.,

Offices and Showrooms: 132, Queen Victoria Street, E.C.
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Gas Mantles in Belfast.—The Belfast and District Chamber of Trade have passed a resolution of protest against "the extension of municipal trading embodied in the resolution of the Gas Committee, and adopted by the Corporation, as to the sale of gas mantles." At a meeting of the Gas Committee, it was agreed to instruct the manager not to sell mantles retail, but in wholesale lots of not less than half-a-gross.

Electricity Losses Borne by Taxes.—According to a decision of the Franklin County Common Pleas Court, at Columbus (Ohio), a municipality may operate electric and other plants at a loss if it sees fit to do so, making up the resulting deficit from taxes. The case arose on an injunction brought by a taxpayer against the Mayor of Columbus, attempting to restrain him from charging a rate for electricity from the city's plant which was alleged to be inadequate to meet the cost of operation. The Court held that no ground for an injunction was stated. The case will be carried to the Supreme Court, and it is being watched with considerable interest, especially by companies operating electric plants, who have frequently contended that owners of municipal plants do not charge enough to pay the actual expenses of operation, and that the taxpayers as a whole carry the cost of lighting for a minority.

Reinforcing Gas Pressures in Birmingham.—The Birmingham Gas Committee recently reported that, owing to the development of the Hall Green district, it has become necessary to reinforce the low-pressure gas distributory system in that neighbourhood by laying a high-pressure main to, and erecting a governor-house at, Billesley, similar to those already in existence at King's Norton and Harborne. The work, which will entail a considerable re-arrangement of the present mains, is estimated to cost £15,700, inclusive of the governors, governor-house, &c. The scheme will be proceeded with and completed as soon as possible, and will form part of the general scheme for improving the pressures in the outlying districts of the area of gas supply. An expenditure of £500 has been authorized for the provision of a boosting plant to be erected at Chester Road, for improving the supply to Sutton Coldfield.

The Threatened Strike at Cheltenham.—Reference was made in last week's issue [p. 163] to an agitation which had arisen for "recognition" by the Cheltenham Gas Company of the Amalgamated Society of Gas Workers, and to the refusal of the Directors to fall in with this request. Among smaller matters, the men are, it is stated, also asking for a schedule of work. If a settlement is not meanwhile arrived at, the written notices handed in by a number of the men will take effect next Saturday.

Electric Lighting for Truro.—At the last meeting of the Truro City Council, Mr. I. Rosskelley moved that an application should be made to the Local Government Board for authority to borrow £10,000 for the purpose of the Truro Electric Lighting Order. He mentioned that the period for which the Order was obtained would lapse in August, and the people who opposed the granting of the Order were only waiting for this to happen so that they might have the opportunity of obtaining an Order and with it a monopoly of lighting in the city. Mr. J. Thomas objected to spending money at the abnormal rate of interest the Corporation would have to pay at present; but the motion was carried.

APPLICATIONS FOR LETTERS PATENT.

427.—Williams, P. F., "Gas-fires." Jan. 11.
474.—Bousfield, T., "Gas fire-lighter." Jan. 12.
479.—Gattenby, J., "Gas-saver." Jan. 12.
513.—Berninghaus, K., "Gas-coolers." Jan. 12.
514.—Schleiniger, C. A. & O., and Keller, J., "Collecting and discharging water from gas and like pipes." Jan. 12.
548.—Yates, H. J., and Davy, J. F., "Gas-burners." Jan. 13.
632.—Ashcroft, E. A., "Treatment of hydrocarbons of the coal-tar series." Jan. 15.
672.—M'Gowan, R. R., "Burners for welding." Jan. 15.
683.—Muller, J. L., and Bonnet, J., "Mantle making." Jan. 15.
729.—Lucas, O. D., "Distilling coal, &c." Jan. 16.

GAS COMPANIES IN THE STOCK EXCHANGE.

Business on the Stock Exchange last week proceeded with satisfactory smoothness; so much so that, by the light of experience gained, some small modifications of the Committee's regulations were found possible, and further relaxations were discussed, which may mature into activity at an early date. The tone throughout was cheerful, with a hardening tendency in prices. The volume of bargains done was scarcely equal to the aggregate of the preceding week, though Tuesday's reckoning was the maximum for any one day yet recorded. As affecting Stock Exchange business, reference may be made to the order issued by the Treasury that its approval must first be obtained prior to any issue of new capital being made. This salutary regulation, of course, will not suit everybody; but in the general interest of the public weal, it should be welcomed. Business in the Gas Market—as in other quarters—was not quite so active as the week before; but prices were generally firm, while some were better. A novel departure may be noted in the fact that bargains marked on the Provincial Exchanges are now recorded on the London Exchange. In Gas Light and Coke issues, the ordinary was strong and active, and prices marked showed an advance upon those of the previous week. Apparently, the announcement that the Company would pay a dividend at the rate of £4 13s. 4d. per cent. (the full statutory rate permissible with the higher price of gas) gave satisfaction.

The bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 91, 91⅛, 91¾, 92, Imperial Continental 83, South Metropolitan debenture 71, 71½. On Tuesday, British 42, 42¼, Bournemouth 4 per cent. debenture 93, 93¼, Dundee 3¾ per cent. 94, 94½, Gas Light ordinary 91¼, 91⅜, 92, 92¾, 93, ditto preference 92, Hornsey 160, South Metropolitan 100⅛, 101. On Wednesday, Gas Light ordinary 92, 93, ditto maximum 70, Imperial Continental 82⅛, 83, South Metropolitan 101, 101⅛, 102, ditto debenture 71, 71½. On Thursday, Bournemouth "B" 14 3/32, 14⅛, 14 3/32, Gas Light ordinary 92, 92⅝, 93¼, ditto maximum 72, 72⅛, Primitiva 5 1/16, ditto preference 4½, 4 9/16, South Metropolitan 100, 101. On Friday, British, Hull 3½ per cent. debenture 69½, 70. Commercial 4 per cent. 100, 100½, Gas Light ordinary 92¼, 93¼, ditto debenture 70¾, 70⅝, 71¼, Primitiva 5, South Metropolitan 100, 100⅛, 101⅛, ditto debenture 70. On Saturday, European 13, Gas Light ordinary 92½, 92¾, 93, 93¼, ditto maximum 72⅛, ditto debenture 70, Oriental 117. The Money Market was still extremely easy.

Bank rate (fixed Aug. 8) 5 per cent.; last year, 4 per cent.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING JANUARY 23

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.		£ s. d.		
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59–64	3 18 2	..
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76–79	5 1 3	..
280,000	5	April 29	7½	Bombay, Ltd.	5¼–5⅝	5 17 8	..
50,000	10	Feb. 26	16	Bournemouth Gas and Water { 10 p.c.	29–30	5 6 8	..
373,480	10	,,	7	Bournemouth Gas and Water { B 7 p.c.	15–15½	4 10 4	14 7/32–14 9/32
95,000	10	,,	6	Bournemouth Gas and Water { Pref. 6 p.c.	13½–14	4 5 9	13 29/32–13 31/32
—	—	—	—	Bournemouth Gas and Water { 4 p.c. Deb.	..	—	93–93¼
380,000	Stk.	Feb. 26	14	Brentford Consolidated	261–266	5 5 3	..
330,000	,,	,,	11	Do. New	204–209	5 5 3	..
50,000	,,	,,	5	Do. 5 p.c. Pref.	109–111	4 10 1	..
206,250	,,	June 11	4	Do. 4 p.c. Deb.	91–93	4 6 0	..
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208–213	5 3 4	..
244,200	,,	,,	8	Do. A Ord. Stk.	154–159	5 0 8	145½–146½
530,000	10	Mar. 26	12½	British	44–45	5 11 1	42–42¼
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88–90	4 8 11	..
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85–87	4 12 0	..
100,000	10	—	—	Cape Town & Dis., Ltd.	1½–2½	—	..
100,000	10	—	—	Do. 4½ p.c. Pref.	¼–⅝	—	..
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70–75	6 0 0	..
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	103–110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106–108	5 1 2	103–100½
560,000	,,	,,	5½	Do. 3½ p.c. do.	103–105	5 1 6	98½
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69½–71½	4 3 11	..
800 000	Stk.	,,	4	Continental Union, Ltd.	76–79	5 1 3	..
200 000	,,	,,	7	Do. 7 p.c. Pref.	115–118	5 18 8	..
—	—	—	—	Croydon B 7 p.c.	..	—	223–224
492,270	Stk.	—	6	Derby Con. Stk.	123–125	4 16 0	..
55,000	,,	—	4	Do. Deb. Stk.	102–104	3 16 11	..
1,002,180	10	July 29	10	European, Ltd.	17½–18*	5 11 1	18
16,362,910	Stk.	Feb. 12	1/17/4	Gas Light and Coke { 4 p.c. Ord.	98–102	4 15 6	91–93½
2,600,000	,,	,,	3½	Gas Light and Coke { 3½ p.c. max.	76–79	4 8 7	70–72½
4,062,235	,,	,,	4	Gas Light and Coke { 4 p.c. Con. Pref.	96–99	4 0 10	92
4,674,850	,,	June 11	3	Gas Light and Coke { 3 p.c. Con. Deb.	72½–74½	4 0 6	70–71½
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87–89	5 12 4	84–89½
70,000	10	April 29	11	Hongkong & China, Ltd.	16½–16⅞	6 11 4	..
—	—	—	—	Hornsey 7 p.c.	..	—	160
131,000	Stk.	Mar. 12	7 3/8	Ilford A and C	151–154	5 2 4	..
65,780	,,	,,	6 3/8	Do. B	115–118	5 8 0	..
65,500	,,	June 26	4	Do. 4 p.c. Deb.	92–94	4 5 1	..
4,940,000	Stk.	May 14	9	Imperial Continental	150–160	5 12 6	82½–83
1,235,000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84–86	4 1 5	..
300,342	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119–121	5 7 6	..
561,000	Stk.	Feb. 26	10	Liverpool United A	211–213	4 13 11	..
718,100	,,	,,	7	Do. B	146–148	4 14 7	..
906,083	..	June 26	4	Do. Deb. Stk.	97–99	4 0 10	..

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.		£ s. d.		
75,000	5	June 11	0	Malta & Mediterranean	4⅛–4⅜	6 9 9	..
250,000	100	April 1	4½	Met. of Melbourne { 4½ p.c. Deb.	99–101	4 9 1	..
541,920	20	May 28	4	Monte Video, Ltd.	11½–12	6 13 4	..
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con.	98½–99½	4 10 6	..
529,705	Stk.	June 26	3½	Do. 3½ p.c. Deb.	82½–83	4 4 10	..
55,940	10	Feb. 26	7 14 0	North Middlesex 7 p.c.	14–15	5 2 8	..
300,000	Stk.	May 14	5	Oriental, Ltd.	117–122	6 11 2	117
60,000	5	Mar. 26	10	Ottoman, Ltd.	7⅛–7⅜	6 9 0	..
60,000	50	Feb. 26	13	Portsea, Island B	128–131	4 19 3	..
100,000	50	,,	12	Do. C	118–121	4 19 2	..
249,980	5	April 29	8	Primitiva Ord.	5⅛–5⅜	6 13 4	5–5 1/16
499,960	5	June 26	5	,, 5 p.c. Pref.	4⅝–5	5 0 0	4 15/16–5 1/16
521,600	100	June 2	4	,, 4 p.c. Deb.	91–93	4 6 0	..
—	—	—	—	,, ,, ,, 1911	..	—	85
346,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85–87	4 12 0	..
150,000	10	May 14	6	San Paulo { 6 p.c. Pref.	10¼–11	5 9 1	..
125,000	50	July 1	5	San Paulo { 5 p.c. Deb.	47–49	5 2 0	..
135,000	Stk.	Mar. 12	10	Sheffield A	223–224	4 9 3	..
209,984	,,	,,	10	Do. B	222–224	4 9 3	..
523,500	,,	,,	10	Do. C	220–222	4 10 1	..
90,000	10	May 28	9	South African	10½–11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.	111–113	4 16 8	100–102
1,295,445	,,	July 10	3	Do. 3 p.c. Deb.	72½–74½	4 0 6	70–71½
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157–159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114–116	5 3 5	108–109
60,000	,,	,,	5	Do. 5 p.c. Pref.	110–112	4 9 3	..
—	—	—	—	Do. West Kent.	..	—	92
137,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116–118	4 4 9	..
629,740	Stk.	May 14	5	Southampton Ord.	99–102	4 18 0	..
120,000	Stk.	Feb. 12	7½†	Tottenham District { A 5 p.c.	135–138	5 8 8	..
742,275	,,	,,	6†	Tottenham District { B 3½ p.c.	115–117	5 2 7	112–113½
181,255	,,	June 26	4	Tottenham District { 4 p.c. Deb.	87–89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd.	5–6	8 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93–95	5 5 3	..
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½–109½	4 11 4	..
30,000	Stk.	Feb. 26	8⅜	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	151–156	5 7 4	..
255,636	,,	,,	6¾	,, B 3½ p.c.	129–134	5 2 7	..
108,075	,,	,,	5/17/3	,, C 3½ p.c.	110–115	5 2 0	..
352,000	,,	,,	6⅛	Wimbledon 5 p.c.	117–122	5 0 5	..
98,000	,,	,,	6⅜	Epsom 5 p.c.	121–126	5 5 2	..
88,416	,,	June 26	3	3 p.c. Deb. Stk.	66–69	4 6 11	..

The Education Committee of the London County Council have accepted the tender of the Plaissetty Manufacturing Company for £93 16s. 10d. (the highest offer) for the purchase of 107¼ lbs. of mantle ash.

Under the title of "Phonolux," a company has been registered with a capital of £2500, in £1 shares, to carry on business as gas and mechanical engineers, and manufacturers of mantles, burners, and lamps.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments Vacant.
ENGINEER. Weston-super-Mare Gaslight Company. Applications by Feb. 8.
FOREMAN (CHARGE OF WORKS). Keighley Gas Department. Applications by Feb. 8.
WORKING FOREMAN. Nixon's Navigation Company, Mountain Ash.
WORKS MANAGER. Woburn Gas Company.

Appointment Wanted.
CLERK. No. 5974.

Gas-Works Wanted.
Particulars to "PRINCIPAL," Scripps's Advertising Offices, 13, South Molton Street.

Plant, &c. (Second-Hand), for Sale.
GASHOLDER AND TANK. Musselburgh Gas-Works.
SCRAP METAL. Halifax Gas Department.

Meetings.
BARNSTAPLE GAS COMPANY. Bridge Hall, Barnstaple. Feb. 13. Twelve o'clock.
SOUTH SUBURBAN GAS COMPANY. De Keyser's Hotel, Feb. 12. Three o'clock.
THE GAS LIGHT AND COKE COMPANY. Horseferry Road. Feb. 5. Twelve o'clock.

TENDERS FOR

Coal.
MILFORD HAVEN URBAN DISTRICT COUNCIL. Tenders by Feb. 13.

Cookers.
BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 16.

Fire Clay Goods (*see also* Retort Settings).
BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 16.
HALIFAX GAS DEPARTMENT. Tenders by Feb. 15.
MANSFIELD GAS DEPARTMENT. Tenders by Feb. 1.

General Stores (Brass Cocks, Lime, Sulphuric Acid, Ironmongery, Steel Goods, Iron and Tin Sheets, Brushes, Oils, Paints, &c., &c.).
BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 16.
DEAL AND WALMER GAS AND ELECTRICITY COMPANY. Tenders by Feb. 2.
HALIFAX GAS DEPARTMENT. Tenders by Feb. 15.

Lamp Fittings.
HALIFAX GAS DEPARTMENT. Tenders by Feb. 15.

Meters.
BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 16.
HALIFAX GAS DEPARTMENT. Tenders by Feb. 15.

Oxide of Iron (New and Spent).
HALIFAX GAS DEPARTMENT. Tenders by Feb. 15.

Pipes, Valves, &c.
BARROW-IN-FURNESS CORPORATION. Tenders by Feb. 16.
HALIFAX GAS DEPARTMENT. Tenders by Feb. 15.

Retort Settings.
WARRINGTON GAS DEPARTMENT. Tenders by Jan. 30.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1915 are reminded that this can only be done during the current month.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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